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Class _____ . No. _____

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OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

ELEVENTH SESSION,

HELD AT WASHINGTON, D. C.,

MAY 4, 5, AND 6, 1897.

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LIST OF OFFICERS.

[Elected May 6, 1897.]

PRESIDENT.

R. W. LOVETT, M.D.

VICE-PRESIDENTS.

W. R. TOWNSEND, M.D.
J. E. GOLDTHWAIT, M.D.

TREASURER.

E. G. BRACKETT, M.D.

SECRETARY.

JOHN RIDLON, M.D.,
103 State Street, Chicago.

COMMITTEE ON MEMBERSHIP.

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W. R. TOWNSEND, M.D. W. J. TAYLOR, M.D.
H. M. SHERMAN, M.D.

EXECUTIVE COMMITTEE.

The President, the Treasurer, and the Secretary.

PUBLICATION COMMITTEE.

J. E. GOLDTHWAIT, M.D. (*Ch'n*), H. AUG. WILSON, M.D.
H. L. TAYLOR, M.D.

MEMBER OF EXECUTIVE COMMITTEE, CONGRESS OF AMERICAN PHYSICIANS AND SURGEONS.

A. M. PHELPS, M.D.
Alternate: E. H. BRADFORD, M.D.

LIST OF PRESIDENTS.

1887. V. P. GIBNEY, M.D.
1888. NEWTON M. SHAFFER, M.D.
1889. E. H. BRADFORD, M.D.
1890. DE FOREST WILLARD, M.D.
1891. A. B. JUDSON, M.D.
1892. BENJAMIN LEE, M.D.
1893. A. J. STEELE, M.D.
1894. A. M. PHELPS, M.D.
1895. JOHN RIDLON, M.D.
1896. ROYAL WHITMAN, M.D.
1897. SAMUEL KETCH, M.D.
1898. R. W. LOVETT, M.D.

MEMBERS.

* Original Members.

1889. Bartow, Bernard, M.D. Clinical Professor of Orthopedic Surgery in the Medical Department of the University of Buffalo; Orthopedic Surgeon to Children's Hospital of Buffalo. 481 Delaware Avenue, Buffalo, N. Y.

1892. Blanchard, Wallace, M.D. Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 34 E. Monroe Street, Chicago.

1889. Brackett, E. G., M.D. Assistant Surgeon to the Children's Hospital. 133 Newbury Street, Boston.

*1887. Bradford, E. H., M.D. Visiting Surgeon to the Children's and the Good Samaritan Hospitals; Assistant Professor of Orthopedic Surgery in Harvard Medical School. 133 Newbury Street, Boston.

*1887. Brown, Dillon, M.D. Adjunct Professor of Diseases of Children in the New York Polyclinic; Consulting Physician (in Pediatrics) to the Astoria Hospital; Visiting Physician to the Episcopal Orphans' Asylum and the St. John's Guild Hospital for Children. 40 East Fifty-seventh Street, New York.

*1887. Bryant, Joseph D., M.D. Professor of Anatomy and of Clinical Surgery, and Associate Professor of Orthopedic Surgery in Bellevue Hospital Medical College; Visiting Surgeon to Bellevue and St. Vincent Hospitals; Surgeon-General National Guard, S. N. Y. 54 West Thirty-sixth Street, New York.

1889. Burrell, Herbert L., M.D. Junior Visiting Surgeon to the Boston City Hospital; Visiting Surgeon to the Children's Hospital; Assistant Professor of Clinical Surgery, Harvard University. 22 Newbury Street, Boston.

1891. Cook, Ansel G., M.D. Orthopedic Surgeon to the Hartford Hospital. 164 High Street, Hartford, Conn.

1893. Coolidge, Frederic S., M.D. Demonstrator of Surgical Appliances in Rush Medical College; Professor of Orthopedic Surgery, Chicago Post-Graduate Medical College; Attending Orthopedic Sur-

geon to the St. Luke's and St. Elizabeth's Hospitals and to the Home for Destitute Crippled Children; Attending Physician to Children, Presbyterian Hospital. 103 State Street, Chicago.

1895. Dane, John, M.D. Junior Assistant Surgeon to the Children's Hospital; Assistant Surgeon to West End Infant Hospital; Surgeon to Marcella Street Orphan Home. 11 Arlington Street, Boston, Mass.

1897. Davis, Gwilym, G., M.D. Univ. of Penna. and Goettingen, M.R.C.S. Eng. Surgeon to the Philadelphia Orthopedic, Episcopal, and St. Joseph's Hospitals. 255 South Sixteenth Street, Philadelphia, Penna.

*1887. Foster, Charles C., M.D. Orthopedic Surgeon to the Cambridge Hospital; Visiting Physician to the Avon Home for Children; Visiting Physician to St. Luke's Home for Children. 5 Riedesel Avenue, Cambridge, Mass.

*1887. Gibney, V. P., M.D. Clinical Professor of Orthopedic Surgery in the College of Physicians and Surgeons, Medical Department of Columbia University; Surgeon-in-chief to the New York Hospital for Ruptured and Crippled; Orthopedic Surgeon to the Nursery and Children's Hospital, and to the Montefiore Home and Hospital, New York. 16 Park Avenue, New York.

1889. Gillette, Arthur J., M.D. Professor of Clinical Orthopedic Surgery in the Minnesota State University; Orthopedic Surgeon to St. Luke's, St. Joseph's, Bethesda, City, and County Hospitals, and the St. Paul Free Dispensary, and Consulting Orthopedic Surgeon to Asbury Hospital. 301 Pleasant Avenue, St. Paul, Minnesota.

1892. Goldthwait, Joel E., M.D. Surgeon to the Good Samaritan Hospital; Assistant Surgeon to the Children's Hospital; Orthopedic Surgeon to Carney Hospital; Surgeon to Marcella Street Orphans' Home. 398 Marlborough Street, Boston.

1892. Griffiths, J. D., M.D. Lieutenant-Colonel and Medical Director First Brigade National Guard, Mo.; President Association of Military Surgeons of the U. S.; Surgeon to St. Joseph's Hospital, Kansas City, Mo.; Consulting Surgeon to German Hospital, Kansas City, Mo.; Consulting Surgeon to Kansas City, Fort Scott, and Memphis R. R. S. W. corner Ninth and Grand Avenue, Kansas City, Missouri.

1892. Hoadley, A. E., M.D. Professor of Orthopedic Surgery and Surgical Diseases of Joints, Chicago Polyclinic; Professor of

Orthopedic Surgery and Surgical Diseases of Joints and Clinical Surgery, College of Physicians and Surgeons; Consulting Orthopedic Surgeon to the Home for Destitute Crippled Children, Chicago. 683 Washington Boulevard, Chicago.

1893. HOSMER, A. B., M.D. Orthopedic Surgeon to St. Luke's Hospital; Attending Orthopedic Surgeon to the Home for Destitute Crippled Children. 103 State Street, Chicago.

1893. HUBBARD, LEROY W., M.D. Senior Assistant Surgeon to New York Orthopedic Hospital and Dispensary. 161 West Twenty-third Street, New York.

*1887. JUDSON, A. B., M.D. Orthopedic Surgeon to Out-patient Department of the New York Hospital. 1 Madison Avenue, New York.

1894. KERR, JAMES, M.D., M.Ch. 1711 H Street, N. W., Washington, D. C.

*1887. KETCH, SAMUEL, M.D. Clinical Professor of Orthopedic Surgery, Woman's Medical College of the New York Infirmary for Women and Children; Attending Surgeon to the New York Orthopedic Dispensary and Hospital; Attending Orthopedic Surgeon to the Montefiore Home and Hospital for Chronic Invalids. 72 West Fifty-fifth Street, New York.

*1887. LEE, BENJAMIN, M.D. Secretary of the State Board of Health of Pennsylvania; Professor of Orthopedics in the Philadelphia Polyclinic and College for Graduates in Medicine. 1532 Pine Street, Philadelphia.

*1887. LOVETT, ROBERT W., M.D. Surgeon to the Infants' Hospital; Assistant Surgeon to the Children's Hospital; Assistant Surgeon to the Boston City Hospital. 234 Marlborough Street, Boston.

1893. MCCURDY, STEWART LE ROY, A.M., M.D. Orthopedic Surgeon to Presbyterian Hospital and East End Dispensary; Professor of Anatomy and Oral Surgery Pittsburg Dental College; Dean Pittsburg School of Anatomy. 1023 Park Building, Pittsburg, Pa.

1889. MCKENZIE, D. E., M.D. Associate Lecturer of Surgery in the Ontario Medical College for Women; Orthopedic Surgeon to the Hospital for Sick Children, Toronto. 14 Bloor Street, West, Toronto, Canada.

*1887. MOORE, JAMES E., M.D. Professor of Clinical Surgery and Orthopedic Surgery in the University of Minnesota; Orthopedic Surgeon to St. Mary's Hospital; Consulting Surgeon to the North-

western Hospital for Women and Children. 802 Dayton Building, Minneapolis, Minn.

1889. Myers, T. Halsted, M.D. Attending Orthopedic Surgeon to St. Luke's and New York Foundling Hospitals; Attending Surgeon to New York Orthopedic Dispensary; Consulting Surgeon to St. John's Riverside Hospital, Home of the Annunciation, and New York Lying-in Hospital. 24 West Fiftieth Street, New York.

*1887. Packard, George B., M.D. Professor of Orthopedic Surgery in the Denver University. 1405 Stout Street, Denver.

*1887. Park, Roswell, M.D. Professor of Surgery in the Medical Department of the University of Buffalo; Surgeon to the Buffalo General Hospital; Consulting Surgeon to the Fitch Accident Hospital and the Buffalo Eye and Ear Infirmary. 510 Delaware Avenue, Buffalo, N. Y.

1890. Phelps, A. M., M.D. Professor of Surgery in the University of Vermont, Professor of Orthopedic Surgery in the University of the City of New York, Medical Department; Professor of Orthopedic Surgery in the Post-Graduate Medical School and Hospital; Visiting Surgeon to the City Hospital, New York; Consulting Surgeon to the Mary Fletcher Hospital, Burlington, Vt.; Surgeon-in-chief to the Orthopedic Department of the Post-Graduate Hospital, New York. 62 East Thirty-fourth Street, New York.

1893. Plimpton, W. O., M.D. Instructor in Orthopedic Surgery, Post-Graduate Medical School and Hospital; Assistant to the Chair of Orthopedic Surgery, University Medical School; Visiting Surgeon to the Post-Graduate Hospital, New York. 40 West Thirty-fourth Street, New York.

*1887. Ridlon, John, M.D. Professor of Orthopedic Surgery in the Northwestern University Medical School and Northwestern University Women's Medical School; Senior Attending Orthopedic Surgeon to St. Luke's Hospital and Michael Reese Hospital; Surgeon-in-charge of the Home for Destitute Crippled Children; Consulting Orthopedic Surgeon to the Mary Thompson Hospital for Women and Children. 103 State Street, Chicago.

*1887. Sayre, Reginald H., M.D. Lecturer on Orthopedic Surgery in the Bellevue Hospital Medical College; Orthopedic Surgeon to the Out-door Department of Bellevue Hospital; Consulting Surgeon to the Hackensack (N. J.) Hospital; Consulting Surgeon to Hospital for Sick Children, Newark, N. J. 285 Fifth Avenue, New York.

*1887. Schapps, John C., M.D. Pueblo, Colorado.

1889. Scudder, Charles Locke, M.D. Assistant in Clinical and Operative Surgery in Harvard University; Surgeon to the Out-patient Department of Massachusetts General Hospital. 189 Beacon Street, Boston.

*1887. Shaffer, Newton M., M.D. Attending Surgeon-in-chief of the New York Orthopedic Dispensary and Hospital; Consulting Orthopedic Surgeon to St. Luke's and Presbyterian Hospitals; Consulting Physician to the New York Infirmary for Women and Children. 28 East Thirty-eighth Street, New York.

1896. Shands, A. R., M.D. Professor of Orthopedic Surgery in the Medical Department of Columbian University; Assistant Physician-in-charge of General Diseases at Emergency Hospital and Central Dispensary; Surgeon-in-charge of Orthopedic Department Emergency Hospital and Central Dispensary; and Attending Physician to Newsboys' Home and Children's Aid Society. 1305 H Street, Washington, D. C.

1889. Sherman, Harry M., M.D. Orthopedic Surgeon to the Children's Hospital, San Francisco. 1303 Van Ness Avenue, San Francisco.

*1887. Steele, A. J., M.D. Professor of Orthopedic Surgery in the Missouri Medical College; Orthopedic Surgeon to the Martha Parsons Children's Hospital. 2825 Washington Avenue St. Louis.

*1887. Taylor, Henry Ling, M.D. Instructor in Orthopedic Surgery in the New York Post-Graduate Medical School; Clinical Assistant at the Hospital for the Ruptured and Crippled. 117 West Fifty-fifth Street, New York.

1897. Taylor, Robert Tunstall, B.A., M.D. Surgeon-in-charge of the Hospital for the Relief of Crippled and Deformed Children of Baltimore City; Clinical Professor of Orthopedic Surgery of the Woman's Medical College; Demonstrator of Orthopedic Surgery in the Baltimore Medical College; Member of the Medical and Chirurgical Faculty of Maryland. 2000 Maryland Avenue, Baltimore, Md.

1892. Taylor, William J., M.D. Surgeon to St. Agnes's Hospital; Assistant Surgeon to the Orthopedic Hospital and Infirmary for Nervous Diseases. 116 South Eighteenth Street, Philadelphia.

1892. Thorndike, Augustus, M.D. Surgeon to the Good Samaritan Hospital; Assistant Surgeon to the West End Infant Hospital and Junior Assistant Surgeon to the Children's Hospital. 101 Beacon Street, Boston.

1889. Townsend, W. R., M.D. Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for

Ruptured and Crippled, New York; Visiting Surgeon to Randall's Island and Bayonne Hospital; Consulting Orthopedic Surgeon to the French Hospital. 28 West Fifty-ninth Street, New York.

1889. WEIGEL, LOUIS A., M.D. Professor of Orthopedic Surgery in the Medical Department of Niagara University, Buffalo; Orthopedic Surgeon to Rochester City Hospital and Out-patient Department; Consulting Orthopedic Surgeon to Provident Dispensary. 209 East Avenue, Rochester, N. Y.

1890. WHITMAN, ROYAL, M.D. Instructor in Orthopedic Surgery and Chief of the Orthopedic Division of the Vanderbilt Clinic in the College of Physicians and Surgeons; Adjunct Professor of Orthopedic Surgery in the New York Polyclinic; Assistant Surgeon to the Hospital for Ruptured and Crippled, New York. 126 West Fifty-ninth Street, New York.

*1887. WILLARD, DE FOREST, M.D. Clinical Professor of Orthopedic Surgery in the University of Pennsylvania; Surgeon to the Presbyterian Hospital; Consulting Surgeon to the White Cripples' Home, the Colored Cripples' Home, and the Home for Incurables, Philadelphia; Consulting Surgeon to the New Jersey State School for Feeble-minded Children. 1601 Walnut Street, Philadelphia.

1891. WILSON, H. AUGUSTUS, M.D. Clinical Professor of Orthopedic Surgery in the Jefferson Medical College; Professor of General and Orthopedic Surgery in the Philadelphia Polyclinic and College for Graduates in Medicine; Consulting Orthopedic Surgeon to the Kensington Hospital for Women, and to the Philadelphia Lying in-Charity. 1611 Spruce Street, Philadelphia.

1893. WIRT, WILLIAM E., M.D. Professor of Orthopedic Surgery in the Medical Department, University of Wooster, Cleveland, Ohio; Visiting Surgeon to University Hospital; Orthopedic Surgeon to Cleveland Hospital for Women and Children. 122 Euclid Avenue, Cleveland, Ohio.

1890. YOUNG, JAMES K., M.D. Professor of Orthopedic Surgery, Philadelphia Polyclinic; Clinical Professor of Orthopedic Surgery in the Woman's Medical College; Assistant Orthopedic Surgeon to the Hospital, University of Pennsylvania; Instructor in Orthopedics in University of Pennsylvania; Surgeon to the Home for Crippled Children; Orthopedic Surgeon, Hospital of the Good Shepherd, Radnor. 222 South Sixteenth Street, Philadelphia.

DECEASED.

Elected.

HONORARY MEMBERS.

1889. Henry G. Davis, M.D.

1892. William Detmold, M.D.

1889. William J. Little, M.D., F.R.C.P. Lond., M.R.C.S. Eng.

1889. David Prince, M.D.

CORRESPONDING MEMBERS.

1892. Nicholas Grattan, F.R.C.S. Edin.

1890. Hugh Owen Thomas, M.R.C.S. Eng.

ACTIVE MEMBERS.

1887. Buckminster Brown, M.D.

1887. Edward Develin, M.D.

1887. Harry Hodgen, M.D.

1887. George W. Ryan, M.D.

1887. Lewis Hall Sayre, M.D.

HONORARY MEMBERS.

ELECTED

1895. WILLIAM ADAMS, F.R.C.S., Senior Surgeon to the Great Northern Central Hospital and to the National Hospital for the Paralytic and Epileptic; Consulting Surgeon to the National Orthopedic Hospital. 7 London Road, St. John's Wood (N. W.), London, England.

1891. EDMUND ANDREWS, M.D., 65 Randolph Street, Chicago, Illinois.

1893. O. LANNELONGUE. Professeur à la Faculté de Médecine de Paris (Chaire de Chirurgie); Membre de l'Académie de Médecine; Chirurgien de l'Hôpital Trousseau â Paris, et Député au Parlement Français, et Président de l'Association Générale de Médecine de France. 3 Rue François I., Paris.

1890. WILLIAM MACEWEN, M.D., LL.D., Professor of Clinical Surgery and Surgeon to the Glasgow Royal Infirmary; Surgeon to the Royal Hospital for Sick Children. 3 Woodside Crescent, Glasgow, Scotland.

1893. LEOPOLD OLLIER, M.D., Professeur du Clinique Chirurgicale à la Faculté de Médecine de Lyon; Correspondant de l'Institut de France. 3 Quai de la Charité, Lyons.

1889. LEWIS A. SAYRE, M.D. Professor of Orthopedic Surgery in the Bellevue Hospital Medical College; Consulting Surgeon to the Bellevue Hospital, the Charity Hospital, and the Home for Incurables. 285 Fifth Avenue, New York.

1891. C. FAYETTE TAYLOR, M.D. 117 West Fifty-fifth Street, New York.

CORRESPONDING MEMBERS.

ELECTED

1889. Dr. F. BEELY. Steglitzer Strasse 10, Berlin, Germany.

1892. Dr. M. BILHAUT, Rédactuer en Chef des Annales d'Orthopédie et de Chirurgie pratiques; Chirurgien des enfants de l'Hôpital International. 5 Avenue de l'Opera, Paris, France.

1894. BERNARD E. BRODHURST, F.R.C.S. Eng., Senior Surgeon to the Royal Orthopedic Hospital; Surgeon to the Royal Hospital for Incurables; Consulting Surgeon to the Belgrave Children's Hospital. 20 Grosvenor Street, Grosvenor Square, London, W.

1894. Dr. JULIUS DOLLINGER, ausserordentlich-öffentlicher Professor für Orthopädie an den königl. ungarischen Universität in Buda-Pest, Operateur und dirigirenden Oberarzt der chir. Abtheilung im Spitalls der Barmherzigen Brüder in Buda-Pest; Mitglied des Landessanitätsrathes; Mitglied des Landesunterrichtsrathes; Mitglied mehrer wissenschaftlichen Gesellschaften und Vereine. Buda-Pest (Ungarn), Rerepescher Str. 52.

1890. Dr. A. HOFFA, Privatdocent der Chirurgie an der Universität Würzburg. Sieboldstrasse 10, Würzburg.

1890. ROBERT JONES, F.R.C.S. Edin., Honorary Surgeon, Royal Southern Hospital. 11 Nelson Street, Great George Square, Liverpool, England.

1890. Dr. E. KIRMISSON, Professeur agrégé de la Faculté de Médecine; Chirurgien de l'Hôpital des Enfants Assisté. 27 Quai d'Orsay, Paris, France.

1890. Dr. SIGFRIED LEVY, Superintending Surgeon of the Society for the Relief of Crippled and Mutilated Children, Copenhagen. 135 Gothersgade, Copenhagen, Denmark.

1892. ERNEST MUIRHEAD LITTLE, F.R.C.S., Eng., Surgeon to the National Orthopedic Hospital. 40 Seymour Street, Portman Square, London, England.

1889. Prof. Dr. ADOLF LORENZ. IX. Garnisongasse 3 (Garellihoff), Vienna, Austria.

ELECTED

1889. HOWARD MARSH, F.R.C.S. Eng., Senior Assistant Surgeon and Lecturer on Surgery, St. Bartholomew's Hospital; Consulting Surgeon, Hospital for Sick Children, and Alexandra Hospital for Hip Disease. 30 Bruton Street, W., London, England.

1890. EDMUND OWEN, M.B., F.R.C.S., Surgeon to and Joint Lecturer on Surgery at St. Mary's Hospital; Senior Surgeon to the Hospital for Sick Children, Great Ormond Street. 64 Great Cumberland Place, W., London, England.

1892. PIETRO PANZERI, M.D., Direttore di Istitutio dei Rachitici, Milano. Via S. Calimero 31, Milano, Italy.

1892. ROBERT WILLIAM PARKER, M.R.C.S. Eng., Senior Surgeon, East London Hospital for Children; Surgeon, German Hospital, Dalston. 13 Welbeck Street, W., London, England.

1890. PAUL REDARD, M.D., Lauréat de l'Institut; Ancien Chef de Clinique Chirurgicale de la Faculté de Médecine de Paris; Chirurgien du Dispensaire Furtado-Heine. 3 Rue de Turin, Paris, France.

1888. BERNARD ROTH, F.R.C.S. Eng. 29 Queen Anne Street, Cavendish Square, W., London, England.

1890. NOBLE SMITH, F.R.C.S. Edin., L.R.C.P. Lond., M.R.C.S. Eng., M.D., Surgeon to All Saints' Children's Hospital; Orthopedic Surgeon to British Home for Incurables. 24 Queen Anne Street, Cavendish Square, W., London, England.

1890. W. J. WALSHAM, F.R.C.S. Eng., M.B. and C.M. Aberdeen, Assistant Surgeon and Surgeon-in-Charge of Orthopedic Department, and Lecturer on Anatomy, St. Bartholomew's Hospital; Surgeon, Metropolitan Hospital; Consulting Surgeon to Hospital for Hip Diseases, Sevenoaks, and to the Burnley Cottage Hospital. 77 Harley Street, London, England.

1890. GEORGE ARTHUR WRIGHT, B.A., M.B. Oxon., F.R.C.S., Senior Assistant Surgeon, Royal Infirmary, Manchester; Surgeon to Children's Hospital, Pendlebury and Manchester. 8a St. John Street, Manchester, England.

CONSTITUTION AND BY-LAWS.

CONSTITUTION.

ARTICLE I.—NAME.

THIS Society shall be called the "AMERICAN ORTHOPEDIC ASSOCIATION."

ARTICLE II.—OBJECT.

The purpose of this Association shall be the advancement of Orthopedic science and art.

ARTICLE III.—MEMBERSHIP.

SECTION 1. The members shall be graduates of regular medical schools, shall be in good professional standing, and shall be especially interested in Orthopedic Surgery.

SEC. 2. There shall be three classes of members, viz.: Active, Corresponding, and Honorary.

SEC. 3. The number of Active Members shall be limited to sixty.

SEC. 4. Candidates for membership shall have been engaged in the practice of medicine for at least five years, and shall have given evidence of satisfactory scientific attainments.

ARTICLE IV.—OFFICERS.

The officers shall consist of a President, a First Vice-President, a Second Vice-President, a Secretary, and a Treasurer, all to be elected annually at the last executive session of a regular meeting.

ARTICLE V.—STANDING COMMITTEES.

There shall be a Committee on Membership, consisting of five members, a Committee on Publication, consisting of three members, and an Executive Committee, consisting of the President, the Secretary, and the Treasurer.

ARTICLE VI.—ELECTIONS.

All elections shall be by ballot; for officers a majority shall elect, for members a four-fifths majority.

ARTICLE VII.—MEETINGS.

The meetings of the Association shall be Regular and Special.

ARTICLE VIII.—FEES.

Active members shall pay an initiation fee of twenty-five dollars, and annual dues of fifteen dollars.

ARTICLE IX.—PUBLISHED PROCEEDINGS.

The business proceedings of the Association shall be published annually. The papers and discussions shall be published annually, unless the Association otherwise directs at the close of the regular meeting.

ARTICLE X.—DISCIPLINE.

A three-fourths vote of all members present at a regular meeting shall be necessary for suspension or expulsion of a member.

ARTICLE XI.—THE CONGRESS.

SECTION 1. This Association shall hold membership in and meet with the Congress of American Physicians and Surgeons.

SEC. 2. It shall, at the first annual meeting held after the adjournment of any Congress, elect a member to represent it on the Executive Committee of the Congress for the ensuing three years, and it shall also elect a second member as an alternate.

ARTICLE XII.—QUORUM.

An actual presence of nine active members at any one meeting shall be necessary for the transaction of business.

ARTICLE XIII.—AMENDMENTS.

Alterations to this Constitution may be made at any regular meeting by a four-fifths vote of all the members present; provided that notice

of the proposed changes, signed by two active members, shall have been given to all the active members at least one month previous to final action.

BY-LAWS.

ARTICLE I.—MEMBERSHIP.

SECTION 1. Nominations for membership shall be made in writing, signed by the proposer and seconder, accompanied by evidence as to the fitness of the candidate for fellowship, and shall be placed in the hands of the Secretary at the previous meeting to the time of the regular meeting.

SEC. 2. Candidates for active membership shall, through the Secretary, present a paper to the Association.

SEC. 3. Only those of acknowledged pre-eminence in Orthopedic Surgery shall be eligible to honorary membership.

SEC. 4. Foreign residents only shall be eligible to corresponding membership.

SEC. 5. All the scientific privileges of the Association shall be accorded to the honorary and corresponding members.

SEC. 6. Membership shall be forfeited when one ceases to take an active interest in the objects of the Association, or is guilty of an unprofessional act or a public misdemeanor. Action in such cases shall be taken according to Article X. of the Constitution.

SEC. 7. An active member absenting himself for three consecutive meetings, or two years in arrears in payment of dues, may be dropped from the rolls.

SEC. 8. All members in attendance at any meeting shall register in a book provided for the purpose.

ARTICLE II.—OFFICERS AND STANDING COMMITTEES.

SECTION 1. The duties of officers and standing committees shall commence after the adjournment of the meeting at which they are elected or appointed, and shall continue until their successors are duly installed.

SEC. 2. The President shall preside at all meetings, shall deliver an annual address, shall appoint a Committee on Membership of five, two of whom shall have served the preceding year, and a Committee on Publication, shall fill any vacancies that may occur from resignation or otherwise.

SEC. 3. The Vice-President shall act in the absence of the President.

SEC. 4. The Secretary shall give due notice of and keep the minutes of all meetings, shall conduct all correspondence, shall notify candidates of their election to membership, and inform members of their appointment on committees, and shall perform such other duties as are assigned to him by the Association.

SEC. 5. The Treasurer shall collect all moneys due the Association, be the custodian of the same, and pay it out only on warrant signed by the President and Secretary. At the annual meeting he shall make a report of his receipts and expenditures, which, after being duly audited, shall be filed.

SEC. 6. The Membership Committee shall consider the eligibility of all nominees for membership, and shall report its recommendations to the Association.

SEC. 7. The Executive Committee shall make all necessary arrangements for the meetings of the Association, assign the order for scientific work, and report the same to all members as early as practicable before the time of the annual meeting; it shall further manage such necessary affairs of the Association as are not already assigned to others.

SEC. 8. The Publication Committee shall attend to the preparation, publication, and distribution of the annual proceedings of the Association; and it shall have discretionary power as to matter for publication in questionable cases.

ARTICLE III.—ELECTIONS.

Election of members shall be held at the first executive session of a regular meeting, and of officers at the last business session.

ARTICLE IV.—MEETINGS.

SECTION 1. The regular meetings shall be held annually during the third week in September of each year, or at such other time and at such place as the Association may elect. If no action should be taken in the matter, the Executive Committee shall decide.

SEC. 2. Special meetings may be called by the Executive Committee or by the President at the written request of ten active members.

SEC. 3. Every third year the Association shall convene as a part of the Congress of American Physicians and Surgeons.

ARTICLE V.—DUES.

The yearly dues shall be paid to the Treasurer at the time of registration.

ARTICLE VI.—PUBLISHED PROCEEDINGS.

SECTION 1. The Transactions shall be printed as soon after the adjournment of the regular meeting as possible, and distributed to the members, one copy to each except to those in arrears on Association dues.

SEC. 2. Additional copies of the Transactions shall be furnished to members at cost, and to the public at a price to be determined by the Publication Committee.

SEC. 3. Authors desiring reprints of their papers will notify the Publication Committee, who shall already have established rates for reprints with the publishers.

SEC. 4. Papers not in the hands of the Secretary within four weeks after adjournment of the meeting shall be omitted from the Transactions on the unanimous vote of the Publication Committee.

ARTICLE VII.—PAPERS AND DISCUSSIONS.

SECTION 1. Papers read before the Association shall be limited to twenty minutes, unless the time be extended by vote. Discussions shall be limited to five-minute speeches. No member shall speak a second time on the same subject if others desire the floor. The author of the paper shall be privileged to close the debate.

SEC. 2. No papers shall be read that have been previously published. Members publishing their papers after they have been presented to the Association shall designate them, "Read before the American Orthopedic Association." Authors desiring their papers illustrated shall furnish the necessary woodcuts.

SEC. 3. Proofs sent to authors should be returned within a fortnight, otherwise the matter will go to press without the author's corrections. Marked changes from copy, known as "time work," shall be paid for by the author.

SEC. 4. Transcripts of the discussion shall be furnished the participants for correction, but not for rewriting.

ARTICLE VIII.—EXECUTIVE.

SECTION 1. Two executive sessions shall be held during each regular annual meeting, to wit: at noon of the first day, and at noon of the last day. The order of business shall be:

1. Reading of unapproved minutes and records.
2. Reports of officers and committees and action thereon.
3. Unfinished business.

4. Election.
5. New Business.

The last act before the adjournment of the last session shall be the reading of unapproved minutes and action thereon. Urgent business may be transacted at any session by unanimous consent.

SEC. 2. The proceedings of the Association shall be in accordance with parliamentary usage.

ARTICLE IX.—AMENDMENTS.

Proposed amendments to the By-laws shall be submitted in writing and signed by two active members. Previous notice of the proposed changes shall be given. A three-fourths affirmative vote of all members present at a regular meeting shall be necessary to ratification.

THE PRESIDENT'S ADDRESS.

THE WORK AND INFLUENCE OF THE AMERICAN ORTHOPEDIC ASSOCIATION.

By SAMUEL KETCH, M.D.,
NEW YORK.

In 1887, just ten years ago, the American Orthopedic Association was born, and took its place as a special society, representing the youngest offspring of surgery. That its youth has been a lusty one, not altogether unattended by the ills that usually accompany infancy, but of a mild type, will perhaps be best shown by a *résumé* of the work as collected from the annual volumes of Transactions. This includes the papers, apparatus, etc., presented from 1887 to the present meeting. Of these papers, thirty-five have been on hip-joint disease, nineteen on knee-joint disease, two on ankle-joint disease, two on wrist-joint disease, three on shoulder-joint disease, and one on disease of the elbow-joint. Forty-nine papers have been read on Pott's disease of the spine, twenty on lateral curvature, two on round shoulders, six on torticollis, and two on sacro-iliac disease. Fourteen papers have been read on congenital dislocation of the hip-joint, one on congenital dislocation of the knee, and one on the same deformity of the shoulder-joint. Forty-three papers on club-foot, embracing the different varieties; nine papers describing the general manifestations and deformities of rhachitis, knock-knee, bow-legs, etc.; six on infantile paralysis, and seven on spastic paraplegia, with their attendant distortions. Seventy-nine papers have been read on other orthopedic subjects, unclassified, and eight skiagraphs have been shown. Thus, all the subjects within the range of our

specialty have been written of and discussed. This does not, however, include many papers which have not been read, some of which have not been reprinted in the TRANSACTIONS, and others which have been rejected by the Publication Committee. It certainly is an evidence of work on the part of the members of which we have every reason to be proud. Representing as it does the best thoughts of busy men, each one of whom has made some sacrifice in order to contribute his experience to the common cause of our specialty, I cannot refrain from congratulating the Association on its past work, and giving expression to the wish that it will be a most reliable index as to its future.

If the work, then, has been satisfactory, how much more so is the influence on the general medical thought which is the direct result of it? This is perhaps best shown by one fact. Up to ten years ago there were but few schools of medicine where any attempt was made to teach the subject of orthopedic surgery, and in but three was there any attempt to give a systematic course of instruction. To-day orthopedic surgery is as much a recognized clinical subject as are the other surgical specialties, and day by day, as our knowledge of the subject increases, is its importance recognized by the student and the general practitioner. Thus it must be admitted that, as a direct outcome of the work of this Association, the position of orthopedy to-day is an assured one, and that compared with the status of former times it has forever passed from the hands of the quack, the instrument-maker, and the bone-setter to the domain of scientific research and skill. Again, the far-reaching influence of this Association is shown by the formation of societies devoted to the special study of orthopedy, both at home and abroad. The work of these bodies, as found in both native and foreign journals, evinces work progressive and of high scientific character, and at no distant day gives promise of an establishment of an exclusive journal devoted to orthopedic surgery. In this connection it is gratifying to see that something more is being done than the mere description of cases, or of apparatus, or of successful results by any one plan of treatment. Prophylaxis, etiology, pathology, and bacteriology are receiving careful investigation, and thus the relation of orthopedy to general medicine and surgery is becoming broader and more catholic in spirit daily. If our work has ad-

vanced so rapidly during the past decade it requires no great gift of prophecy to predict a still more manifest progress in the future. With the aid of the collateral studies already mentioned and the assistance of the Roentgen rays, which seem to be peculiarly applicable in our own specialty, many of the problems which are still obscure should be cleared up. The importance of the early recognition of symptoms of disease and deformity, and the emphatic teaching of the same, we should most urgently and persistently persevere in. We certainly can, by thus early attacking the maladies, avert many of the distressing results only too often seen in later life. Again I should urge the influence of this Association against the indiscriminate advice, prescription, and application of apparatus by ignorant instrument-makers and vendors of surgical instruments. The mischief, incalculable in extent, thus done is only too well known to all of us. If the ophthalmologists of New York find it necessary to present a bill to the Legislature to regulate the prescription of glasses to those who are competent to do so, it would certainly seem equally important that legislation should protect the unfortunate diseased or deformed against the cupidity and ignorance of the instrument-maker. As stated in another paper, "the place of the instrument-maker is simply to construct an apparatus. It is the duty of the surgeon to attend to its proper application."

It certainly would seem that the remark not infrequently made concerning our specialty—*i. e.*, that it was limited to exceedingly narrow confines—has no foundation in truth. If, as proven by our work in the past, each year has produced new ideas and new discoveries, it shows that while much is still open to us, and that much remains to be studied, that at all events we are progressive. If any criticism can be made on our work, it is that we strive more for practical ends than theoretical studies. Surely not a very harsh or uncomplimentary one. Still, the fields of our work, which will well bear tilling, are to be found in the pathological and etiological considerations of many subjects. The desire for brilliant achievement in both mechanical and surgical procedures can well give way to study and research in the undiscovered sources of deformity, congenital and acquired, and also toward a solution of the many vexed questions regarding joint and spinal diseases. The

programme of the present meeting gives promise of a most profitable contribution to the literature of our specialty, and again shows the unabated interest of the members in our common object—the advancement of orthopedic surgery.

I cannot close this address without some reference to those whom death has removed from our midst during the past year.

First, that venerable nestor of our art—Henry Gassett Davis.

He was born in Trenton, Maine, November 4, 1807, and died at his residence at Everett, Mass., aged eighty-nine years. His early education was obtained in a common school. In the winter of 1835 and 1836 he attended medical lectures at New Haven, and the next spring he went to Bellevue Hospital as assistant physician. Dr. Davis was a graduate of Yale Medical School in March, 1839. He practised in Worcester a short time, and then went to Milbury, where he treated a large number of patients from the surrounding towns. In 1855 he left Massachusetts for New York City, to engage in the practice of his specialty. He remained in New York until ill health compelled him to return to Massachusetts. To Dr. Davis, American orthopedic surgery is indebted, more than to any other man, for the advancement of the so-called American method of treatment in joint and spinal disease.

In the words of a former President of this Association, Dr. E. H. Bradford, "it is to his suggestion that we, as members of the Association, owe more than we realize in the treatment of hip-disease, in the treatment of caries of the spine, in the elastic correction of deformity. It is hardly an exaggeration to say that before his time the general treatment of hip-disease in common surgical practice was the actual cautery, or the seton, and we all know the results which we can gain by treatment which has grown from his suggestion. Whether we know it or not, we are all followers of the teachings of Dr. Davis."

The American Orthopedic Association elected him an honorary member in 1895, and though just past his eighty-ninth birthday, he retained his mental faculties and his interest in his profession and this Association up to the time of his death. His work, entitled *Conservative Surgery*, may still be read with interest and profit.

Among those who were with us at the original meeting of this Association we find the names of Harry Hodgen, of St. Louis; A.

Sydney Roberts, of Philadelphia, and George W. Ryan, of Cincinnati, all of whom have died within the past year.

Harry Hodgen was born August 21, 1855, at Pittsfield, Pike County, Ill., and was the eldest child of the late John T. Hodgen, whose name is indelibly connected with the progress of scientific surgery in the West.

In the fall of 1856 his parents moved to St. Louis, Missouri, where his father engaged in the practice of medicine, and in this city Harry Hogden attained his education at the public schools.

He married in 1875 and moved to Texas, where he engaged in stock and cattle raising. The great droughts of 1877, 1878, and 1879 practically annihilated his prospects in this line, and he returned to St. Louis, entering the St. Louis Medical College and graduating with the class of 1883.

He at once began the active practice of medicine, was appointed curator of the college museum and assistant at the surgical clinic.

Inheriting from his father in a marked degree mechanical ingenuity and inventive ability and an ever-active and inquiring mind, the causes of and remedies for malformations of the framework of our human body had for him more than ordinary interest, and he devoted especial attention to orthopedics. In 1887 he was appointed lecturer on this subject in his alma mater, and the professorship of orthopedic surgery in the same institution was bestowed upon him in 1895.

He suffered from an attack of acute nephritis four years before his death, from which he never entirely recovered, and undoubtedly throughout the remainder of his life suffered much and did his work at a great disadvantage.

In June, 1896, his state of health became such that he was prevailed upon to leave St. Louis for what was intended to be a six weeks' or two months' rest. Going to the western coast of the Lower Peninsula of Michigan, he stayed until August 24th, when he went with his wife to the Alma Sanitarium, at Alma, Michigan, thinking that the quiet of the sanitarium might be beneficial. At that place he died on August 29th, and his body is buried beside that of his father, in Bellefontaine Cemetery, in St. Louis.

His demeanor was such that few but his family and intimate friends could fully realize the height of his ideals, his kind-heart-

edness, and his extreme self-sacrifice and devotion to those he loved.

"He never sought to make a favorable impression, but was satisfied to trust to the keen discernment of the worthy for proper appreciation. He was earnest, industrious, and faithful as a physician, as the head of a family, and as a citizen. Ill-health had been his constant companion for many years, and yet he never complained, nor did he deviate from the straight line of earnest, honest work. His desire to achieve a place in his profession and to properly serve his family, to which he was almost fanatically devoted, prompted him to deny himself the rest and vacation, from time to time, which he should have had during many years past. He kept in the harness, hard at work, almost to the last."

In the prime of life, just when the greatest measure of success was in sight, he was removed from the field of his work.

Algernon Sydney Roberts was born in Philadephia, December 19, 1855, and died at Newport, August 17, 1896. Although at the time of his death Dr. Roberts was not a member of this Association, having retired from the active practice of his profession several years ago, his name and work are so identified with the early history of this Association that it seems to me appropriate that something of his life and work should be perpetuated in the annals of this Society. Dr. Roberts was educated at private schools and by private tutors at home. He matriculated in the University of Pennsylvania Medical Department in 1873, Prof. W. W. Keen being his preceptor. He graduated therefrom in 1877. After graduating he served as interne at the Philadelphia Hospital. He was appointed general surgeon of the Philadelphia Hospital, and served from 1877 to 1885; surgeon to the Episcopal Hospital from 1879 to 1880; assistant surgeon to the New York Orthopedic Dispensary and Hospital from 1880 to 1882, and was appointed an instructor in orthopedic surgery in the University of Pennsylvania from 1882 to 1888. To Dr. Roberts is due the credit of establishing the orthopedic clinic in connection with the University Hospital and for the first attempt at systematic instruction in orthopedic surgery in his native city. He retired from practice in 1889. To orthopedic literature he has contributed the following articles: "Club-foot," "Pott's Disease," "The Spinal Arthropathies," clini-

cal lectures on orthopedic surgery, and various other articles pertaining to this branch of surgery. He also devised several useful appliances. Although not actively engaged in the practice of his specialty at the time of his death, Dr. Roberts always manifested a keen interest in the progress of orthopedic surgery.

George William Ryan was born in Louisville, Ky., August 3, 1859. His education was begun in the common school in Louisville and continued at St. Xavier's College, from which he graduated with the highest honors in 1876. He entered upon the study of his chosen profession, graduating from the University of Louisville with medal honors. He began his professional career with the late Drs. L. P. Yandell and R. D. Cowling. Subsequently he went to New York and entered the Hospital for the Ruptured and Crippled, serving four years upon the staff of that institution. He moved to Cincinnati, Ohio, practising his specialty, and soon earned an enviable reputation as an orthopedic surgeon. He became professor of surgery at the Laura Memorial College, and clincial lecturer at the Ohio Medical College, a member of the surgical staff of the Good Samaritan Hospital and the Presbyterian Hospital, and was also chief surgeon at St. Mary's Hospital. He was closely associated with the medical societies of Cincinnati, and contributed much to the advancement of his specialty in the city of his adoption. His personal characteristics are well known to you all. We shall all miss his hearty laugh, his ever-ready wit, and his cheerfulness on all occasions. We all deplore the untimely close of a life rich in achievement, but fuller of promise.

Among our corresponding members I have to note the death of Mr. Nicholas Grattan. Mr. Grattan was, as far as we know, the only surgeon in Ireland who made a specialty of orthopedic surgery. Mr. Grattan was a Fellow of the Royal College of Surgeons of Edinburgh, and was one of the original surgeons of the County and City of Cork Hospital for Women and Children.

Owing to the fact of my inability to obtain accurate data, I am unable to give information regarding Mr. Grattan's earlier work or the dates of his birth and death.

He will be best remembered by us for his invention, description, and demonstration of the osteoclast which bears his name. He impressed us all as a most earnest and honest worker and devoted to his art.

ERASION OF THE KNEE IN CHILDREN, WITH CONSERVATION OF THE EPIPHYSEAL CARTILAGES.

By HARRY M. SHERMAN, M.D.,
SAN FRANCISCO, CAL.

This paper is simply a report of three cases, the work on which was somewhat experimental, though not on any new lines. In all three cases a distinct effort was made to conserve the function of the epiphyseal cartilages, even though their anatomical integrity was impaired.

The effect of the removal of the epiphyseal cartilages on the proper development of all the tissues of a limb is well known, and the importance of retaining them with their function intact is self-evident. In the volume of our Transactions for 1891 Roswell Park has given an admirable review of the theories which have been advanced to explain the occurrence of atrophy or lack of proper development, and I refer you to this for the views of the reasons for the atrophy of the entire limb sequent to the destruction of an epiphyseal cartilage.

Koenig has stated that tuberculosis, if primarily of epiphyseal location, but rarely attacks the diaphysis. It may be presumed that the non-vascular disk of cartilage offers a barrier to the dissemination of the bacilli into and through the cancelli of the shaft itself; but, as we all know, it is impossible to say how many distinct foci of infection may be in an epiphysis, nor can we be sure that we have removed all of them so long as any of the osseous portion of the epiphysis remains. Hence there is an argument in favor of the total removal of an epiphysis which is the seat of a tuberculous infection at the same time that the other involved joint structures are removed.

Fig. 1.

Fig. 2.

Fig. 3.

Fig. 4.

The question presented for solution in two of these cases was this: Is it possible to remove the articular cartilages of the tibia and femur at the knee, and also all of the ossified portions of the epiphyses, scraping them carefully from the epiphyseal cartilage, and not interfere with the physiologic function of the latter? Cartilage growth must take place as an interstitial development or by proliferation on its diaphyseal side. Hence, if we can operate in this way, without interfering with cartilage proliferation and ossification, we can conserve the growth of the limb, and one of the arguments against an operation on a child, which would otherwise be justifiable, will be removed. If in one single instance the usual growth of the bone continues after this operation, the question will be answered in the affirmative.

Two of these cases presented themselves at my clinic late in the disease, when the knees were much flexed, the tibiæ subluxated backward, the tissues posterior to the joints rigidly contracted, and with sinuses opening on the fronts of the joints. Both were subjected to gradual corrective treatment by Billroth brackets until the postarticular structures had been so far stretched as to permit the tibia and femur being placed in line after the removal of the epiphyses. During this period of protective treatment there was but little improvement in the tuberculous condition.

Similar operations were done on each, total arthrectomies and epiphysiectomies. In each the patella was removed, and in neither were the femur and tibia sutured, their apposition after the operation being maintained by very carefully applied plaster-of-Paris splints. Healing was in each uneventful, except that small sinuses persisted for a time after the major part was healed. Each left the hospital with a straight leg, and in each flexion occurred while the child was under observation and in spite of solid plaster-of-Paris splints. In one, the younger, the force of the flexion was so great as to cause pressure sores over the front of the bone, from the persistent contact with the rigid opposing splint.

The radiographs (Figs. 1 and 3) show the amount of this movement of flexion in each case, and also that union between femur and tibia was finally apparently bony; and this could have been assumed from ordinary clinical evidence, for flexion has ceased to increase, and the position of the bones has been stable for something over a

year in each. But in one of the cases a radiograph taken from another direction (Fig. 2) shows a short line of fibrous tissue between the bones, and that the apposition was not perfectly maintained, a certain amount of outward displacement of the leg having occurred.

The radiographs also show that there has been developed in the place of the epiphyses—between the opposing ends of the diaphyses—a considerable amount of new bone, and it is possible that the excessive development of this in the anterior portion, as compared with the posterior, was the cause of the irresistible flexion which occurred. In consideration of the conditions under which this flexion took place, it is, I am quite sure, necessary to look for some much stronger force than contraction of postarticular tissues or muscular work, though why more bone should be produced in the anterior rather than in the posterior portion of the space I am at a loss to even surmise.

In one case (Figs. 1 and 2) the evidence is in favor of some growth having taken place at the knee since the operation. The difference between the lengths of the legs one year after the operation was 4.5 cm., and two years later it is 6.2 cm., making allowance for flexion; a less development by 1.7 cm. for the leg that was operated on. Now, most of the growth of the lower limb takes place at the knee, and in this two years the sound limb has grown 9.5 cm., and it seems that the loss of 1.7 cm. should have been greater if no growth except at the hip and ankle had taken place in the operated-on limb. As regards the segments of this limb, the leg has grown more than the thigh by about 2 cm., showing, I think, that the tibial epiphyseal cartilage was less damaged than was the femoral. Looking now at the radiographs (Figs. 1 and 2) it is seen that the fibula, a bone the integrity of which was not disturbed, has not outgrown the tibia. It seems fair on this ground, also, to assert that the tibial epiphyseal cartilage is still functionating; that the growth of the tibia is keeping up with that of the fibula; and that the increase in the difference in lengths of the limbs is due to interference with the developmental processes of all the tissues, quite as much as to any local inhibition in any set of epiphyseal cartilages.

The radiograph of the other case (Fig. 3) lends force to this

argument, for here the fibula has plainly outgrown the tibia, and can be seen to be thrust up above it. Surely in this case the tibia is not keeping pace with the fibula in growth. In almost every other particular this case is like the first.

The third case is quite different. The patient, a boy of ten or eleven years, was seen very early in the disease, and was put at once on protective treatment. He did very well, except that there persisted a spot of tenderness over the inner tibial tuberosity, and the tissues here were always boggy and with appreciable condensation. The tibia was trephined at this place, and the entire ossified portion of the epiphysis—the seat of a locally disseminated tuberculosis—was removed with a small, sharp spoon, leaving only a shell of cartilage. There was also a tuberculous region in the juxta-epiphyseal portion of the diaphysis, and this, too, was removed in the same way. Thus I had two cavities, separated by the central portion of the epiphyseal cartilage. This portion promptly sloughed, making one cavity of the two, but the circumferential portions lived, as did the articular cartilage; the wound, dressed by gauze packings, slowly closed, and the natural growth of the bone has been resumed, the slight amount of shortening which exists (4 c.m. in the whole limb, but only 1.5 c.m. in the tibia) not having increased. The radiograph shows that the cavity has been filled, apparently, by bone, for it is impossible to make out its exact outlines. (Fig. 4.) The functions of the joint and bone are practically perfect.

In this case the mechanical interference with the epiphysis was not much less than in the two former cases, except that access to the bony epiphysis was had from the side instead of from the articular surface. Yet here the developmental processes have suffered but little, in striking contrast to the second case, in which the tibia is hanging behind the fibula in growth.

DISCUSSION.

Dr. R. W. Lovett, of Boston, said that his experience had been chiefly with late excision of the knee. In his opinion the results gained in this line of work were extraordinary. Recently he had removed the lower third of a femur, which was badly diseased, from a child who was in a very bad condition. He had not removed all of the diseased bone then, but after consultation it had seemed wise to discontinue further operative measures. Notwithstanding this fact, the child had improved very markedly, and the limb had yielded a good result. His experience at the Children's Hospital, in Boston had been fairly satisfactory as far as the conservative treatment went. If, on opening an abscess, the joint were found seriously disorganized, the diseased part should be taken out. His experience with arthrectomy had been very discouraging. Our progress in the treatment of hip-disease would probably be in the direction of earlier excision in selected cases; yet, in his personal experience, he had found that the conservative treatment of early cases of knee-disease had been quite satisfactory, and it was rather opposed to operative treatment in knee-joint disease.

Dr. W. R. Townsend, of New York, said that he had been interested in the paper for the reason that the patients were young children. He recalled one or two cases occurring in adults in his own practice. In one of these the patient was doing remarkably well, but suddenly, and without warning, an abscess developed. Although excision was promptly performed, the patient died of hemorrhage from the divided ends of the tibia and femur—a very rare occurrence. In his experience excision would have to be performed more frequently in adults than in children, and the indications were for an earlier excision.

Dr. Blanchard, of Chicago, said that his results had been much more satisfactory in adults than in children. In quite a number of adult cases they had been exceedingly satisfactory, whereas in children they had been quite the reverse, going on to a point where excision was demanded.

THE PRESIDENT said that he had understood Dr. Sherman to advocate a modified excision, by which the epiphyseal cartilage was saved. If he recollected correctly, some years ago certain German surgeons had located what they thought to be the focus of disease, especially in the hip-joint, and had operated, but not with very good results. Dr. Yale and Mr. Wright had referred to these results in their published writings. Flexion after excision of the knee-joint had been observed by all after the limb had been placed in good position. In many cases that he recalled the flexion had almost equalled the amount of original deformity. Several such cases had been presented to the Orthopedic Section of the New York Academy of Medicine. His experience was that the conservative treatment of knee-joint disease in children was favorable. In operations at an early age, as in the case reported by Dr. Sherman, one sometimes experienced difficulty in detecting the area of disease.

DR. SHERMAN, in closing, said that he had not been altogether understood. The three reported cases were all late operations, two of the children coming to him after the disease had existed for a long time. The other child, in whom the epiphysis of the tibia was removed, and the disease found to be limited to that place, was also a late operative case. In this one conservative treatment had succeeded in conserving the joint-tissues, as there had been no extension of the disease from the original focus.

The question of focal operations at an early stage he had merely alluded to. Mr. Wright and Mr. Barker were both radical in their treatment of tuberculous joint-lesions where what they called suppuration had taken place, but he had never been able to understand from their writings whether they referred to a cold tuberculous abscess or an abscess due to mixed infection. In the one case the abscess should be considered only as a symptom of a tuberculous lesion, which might be comparatively small and insignificant; in the other case sepsis was added to the tuberculosis, and the condition was a desperate one. Dr. Dane had attempted to differentiate these conditions by studies of the blood, and he had himself endeavored to supplement these efforts by asking Dr. Philip King Brown, of San Francisco, to repeat Dr. Dane's inves-

tigation, in order to determine, if possible, whether an abscess connected with bone-disease was or was not the seat of a mixed infection.

Mr. Cheyne went further than Mr. Barker and Mr. Wright in advocating operation upon a lesion as soon as he could definitely locate it by the swelling and tenderness. In children it was difficult to locate such a focus by tenderness, but the thickening of the tissues might lead one to suspect the presence of such a focus. Mr. Cheyne's suggestion, he thought, would be applicable to all joints except the hip. He had tried it on three cases of hip-disease. Two of these died and the other came to an excision. Drilling about the hip, necessarily without the proper guidance of vision, was a very uncertain and unsatisfactory procedure. Owing to the deep situation of the hip-joint and the absolute inability of the operator to know whether or not he had removed all the diseased tissue, the hip-joint should be excluded from these early focal operations. We know now the more common locations of the early foci of disease, and hence we could ordinarly do an exploratory operation. In two or three instances he had gone into the epiphysis of the femur with the idea of finding a tuberculous focus, and had found his diagnosis to be erroneous. The operation had been done with a small trephine, and the exploration left the joint in no way impaired. Recently he had explored the tibia in the same way, and without bad result.

The whole question of the treatment of joint-lesions depended very largely upon our ability to estimate accurately the vitality of the patient. Those who lacked the necessary vitality should be subjected to early and radical operations ; others might be let alone. Some cases could live for many years in spite of extensive bone-disease; others could not, and hence the necessity of differentiating between these cases.

TRAUMATIC SPONDYLITIS.

By ARTHUR J. GILLETTE, M.D.,
ST. PAUL, MINN.

I USE the term trauma, as the conditions here reported followed immediately after an injury. The first case was seen with Dr. Reed, of this city, when he was stationed at Fort Snelling, Minnesota.

The injury was the result of a slight slip on the sidewalk, and was suddenly followed by paraplegia, the area of anæsthesia extending up to almost the nipple-line. He remained in this condition for five months, at which time I first saw him.

I noticed a slight prominence in the upper dorsal and in the lumbar spine. This prominence would not have been considered due to caries, however, had it not been for the rigidity in this region, the radiating pains, paralysis, etc.

He had a temperature-range which was quite typical of tuberculosis. His pain was more extreme, however, than is usual in chronic disease of the vertebræ, and while extension and immobilization relieved the pain somewhat, yet he did not receive the marked relief which is our experience in spondylitis. At this time there was no evidence of lung disease, though it developed later and ran a rapid course, but he never had a cough.

The post-mortem revealed a very interesting and striking condition—the entire vertebral column, at least from the upper dorsal to the sacrum, was soft and spongy, and a knife would easily penetrate any of the bodies of the vertebræ; in fact, the vertebræ could be crushed between the fingers. This was also the condition of the crest of the ilium and of the ribs and sternum, and there was complete destruction of the intervertebral disks. The spinal canal contained fluid of a coffee-color, due to small hemorrhages.

There was extensive disease of the lungs, tuberculous in character, enlarged liver, and a markedly enlarged spleen.

This was the extent of the post-mortem as per agreement with the relatives, and we were not allowed to remove any tissues.

CASE II. was a young man, about thirty-five years of age, of perfect physical development. He was a fireman by occupation, and was obliged to pass a physical examination before admittance to the fire department was granted. A few months before I saw him he severely sprained his back while lifting. He was unable to continue work, although there was no involvement of the cord for some time after the injury.

When I saw him he was unable to walk; there was exaggerated knee-reflex and marked ankle clonus; any sudden jar or quick movement caused pain in the sides, back, and legs. There was a slight prominence in the lower dorsal spine and the muscles were rigid the entire length of the spinal column. The pain was not confined to the region supplied by the nerves which originate from the supposed diseased area, but the entire body, neck, shoulders, and sides were complained of with any movement.

I diagnosed Pott's disease, and attempted to apply a plaster cast. While the patient was partially suspended he had an attack of syncope which was quite alarming. In fact, I doubt if he ever fully recovered from the shock, which was caused by attempting the application of the cast, as he was a great deal weaker, the spine more tender, and headaches much more severe.

I succeeded in getting a leather corset made, which gave him considerable relief, yet not the relief I had promised. The paralysis continued until there was retention of urine and loss of control of the bowels. The head symptoms—pain, semi-consciousness, delirium—and the temperature varying from subnormal to 101° F., led me to diagnose basilar meningitis.

These symptoms continued for some weeks. One morning I was suddenly called as he had a severe attack of coughing and choking. I found his respiration very much embarrassed, and all of the physical signs of pleural effusion of the left chest, and quite remarkable, too, the brain lesion had seemingly been relieved.

He was too weak and exhausted to attempt to withdraw the fluid in the pleural cavity, and he shortly died. I felt sure that this

effusion into the pleural cavity had not existed before this sudden attack of dyspnœa and coughing, for if it had existed it must have been very slight, as there had been no previous symptoms, and I had repeatedly examined the chest. I could only account for this sudden effusion and the relief of the brain and cord symptoms—that is, pain and delirium, for it did not affect the paralysis—by an abscess rupturing, which had caused pressure on the cord and had emptied itself into the pleural cavity.

He shortly died, and the suggestion of a post-mortem was met with remonstrances, but examination of the spinal cord was allowed. We found the canal filled with sero-purulent fluid, the spinal cord intact, and its membrane softened. In the upper dorsal region was found a sinus passing through a left intervertebral foramin, and a probe passed through here communicated with the left pleural cavity, which cavity contained fluid of the same macroscopic appearance as that found in the spinal canal. Upon removing some of the vertebræ, there was periostitis having the appearance of the periostitis albuminosa described by Ollier. There was no pus, but a serous synovia-like fluid with evidences of inflammation in and around the bone. Upon denuding the vertebræ there was a carious condition of not only the anterior but the posterior segment as well. This condition of the periosteum and of the bones extended through all the vertebræ examined, which consisted of the dorsal and lumbar.

Case III. was a robust young man, following the occupation of a woodsman. While doing some heavy lifting he sprained his back, and while it was not so severe that he was obliged to cease work at once, yet it so interfered with his occupation that he returned home. He consulted his family physician, who, finding that counter-irritation, rest, and the ordinary treatment for sprained back did not relieve him, referred him to me.

At this time there was seemingly a slight prominence of the two first lumbar vertebræ, but he complained of pain somewhat above this region as well. He was referred back to the family physician with the usual instructions advised in such cases; it was supposed to be a case of caries of the vertebræ.

The patient continued to grow worse, especially was the pain increased in the upper dorsal and lower cervical vertebræ, radiating to the shoulders and arms. His temperature seldom went above

normal, though at times it was as high as 101° F., but this was thought to be due to an acute nephritis which disappeared in a short time. He also had some œdema of the lower extremity; there never was, however, any symptoms of spinal cord involvement.

Considering the length of time he was ill and the great pain he suffered most of the time, the excellent condition of his general nutrition was surprising. When I saw him some little time before death, I thought I could detect a well-marked prominence of the three upper dorsal vertebræ, the pain in the shoulders, arms, and neck, and its increase upon any movement of the upper extremity or head, led me to diagnose another area of caries of the vertebræ.

This condition existed for a number of months. When death occurred we succeeded in getting permission for a post-mortem.

The vertebral column and its contents were removed from the last cervical to the sacrum, and a portion of each lung and the kidneys and spleen were given to a pathologist for examination. The following is his report:

The right kidney presented on section a very narrow cortex, which was pale and streaked with injected bloodvessels, contrasting distinctly with the darker pyramids. On stripping the capsule portions of the kidney were torn off with it, giving a roughened appearance to the surface of the kidney. The liver was soft, friable, and showed macroscopic evidence of fatty degeneration. Small portions of the lungs (taken from the apices) showed nothing of importance (no evidence of tuberculosis). The spleen was as large as the liver ordinarily should be (weight three pounds four ounces). On the convex surface there was a band of white tissue, seemingly fibrous, extending from the notch across the end of the spleen. On section underneath the capsule this band was found to consist of a dense, yellowish, cheesy looking substance, about one-half inch thick.

The surface of the spleen is very dark red and mottled. On section the spleen pulp was very dark red, the vessels much injected, with here and there small spots of hemorrhage. The bright-red color of the blood as it oozed from the severed vessels on the cut surface was particularly striking, in contrast with the dark hemorrhagic spots and reddish-gray substance of the spleen-pulp, the spinal column (the lumbar and seven lower dorsal submitted). The

vertebræ showed the spongy portion everywhere involved to a greater or less extent, presenting in a lesser degree areas of normal bone structure, while in the bodies of several vertebræ the spongy bone was reduced to a dark red pulpy mass. On sawing through the bodies of the several vertebræ this process was found to be more advanced in certain sections of the spinal column than in others. Thus the bodies of the lower lumbar vertebræ were reduced to a dark, pulpy mass with only a network of bony structure left in the spongy portion. Above this there were two vertebræ in which the process was much advanced. Still further above this a group was found very much involved, and no vertebræ of those examined entirely escaped. The integrity of the spinal column was maintained by the thin shell of compact bone which surrounded the pulpy mass. Even the intervertebral disks were involved and were soft and swollen. It was observed that in instances in which the body of the vertebræ was but little involved, the processes were often reduced to a dark-red, pulpy mass enclosed in a shell of compact bone.

Microscopical Examination. The kidney showed marked evidence of degeneration of the renal epithelium, with areas composed of lymphoid cells infiltrating the interglandular structure. The liver shows some degeneration of liver-cells, they having become granular and lost their contour. There were here and there areas of infiltration of lymphoid cells and a marked proliferation of connective tissue in and about the walls of the bloodvessels.

Sections of the spleen show a homogeneous structure consisting of cells not to be distinguished from ordinary cells constituting the spleen-pulp, with here and there marked dilatation of bloodvessels and occasional hemorrhages. There was little or no apparent increase in the connective tissue constituting the trabecula. The yellowish band seen on the surface of the spleen was found to consist of a homogeneous caseous-looking mass which did not take the staining.

Section through the body of the vertebræ showed the dark portion to consist of a bloody mass in which were numerous nucleated red blood-corpuscles in all stages of development. Cells with eosinophile granules, and here and there large mononuclear cells in the process of division, mitosis being quite evident, were to be seen.

SPONDYLOLISTHESIS, WITH DESCRIPTION OF A CASE.

By ROBERT W. LOVETT, M.D.,
BOSTON.

The name spondylolisthesis (σπόνδυλος, a vertebra, and ὀλισθήσις, a gliding) refers to a forward subluxation of the body of one of the lower lumbar vertebræ, with the exception of one recorded case where the upper part of the sacrum was displaced forward. This displacement has ordinarily been described as a dislocation; in most instances it hardly reaches a greater degree than may be described by the name subluxation. Even this name is incorrect anatomically. This is because the body of the vertebra is chiefly affected, while the laminæ and spinous process remain practically in place.

The condition has attracted attention chiefly from the obstetrical point of view, on account of the secondary pelvic changes produced, and surgical literature contains next to nothing about it. Fr. Neugebauer,[1] of Warsaw, has so thoroughly investigated and elaborated the subject that whoever strives to elucidate it from any point of view must do so largely by quotations from his extensive writings.

In 1854, when this condition was recognized and named by Killian,[2] there were described only four known anatomical specimens. In 1890, when Neugebauer's treatise was written, there were one hundred and one clinical and anatomical observations. Blake,[3] Gibney,[4] and Lombard[5] contributed the only recorded American observations. Between the publication of Neugebauer's classic in 1892, which was written in 1890, and to-day there have been reported, so far as I could find, twenty-four more cases (two in men).

The later cases add little to the surgical interest, excepting those

of Dollinger, where the deformity occurred in a child of three years, as the result of a fall; the case of Lane, reported in 1893, where laminectomy was performed for the relief of pressure symptoms and the lamina of the fifth lumbar vertebra removed; the preparations by Chiari, which are of pathological interest; and the case described by Braun von Fernwald, which, with his paper, is noteworthy for its completeness and pathological interest (see Reference to Recent Literature, p. 34). So far as could be learned, no American case has been added to those of Neugebauer's list, except the one here described.

Lane* dissents from Neugebauer that the affection is one of great rarity, believing that it occurs commonly among people who perform heavy manual labor, and he goes so far as to state that "looking at the changes which the skeletons of laborers undergo, I found that in fully developed coal-heavers spondylolisthesis is the normal condition, and that in other occupations a similar displacement existed." On the whole, however, the tendency of opinion seemed to be with Neugebauer, that the affection is a rare one, and that the pathological scheme proposed by him is, on the whole, a correct one.

FIG. 1.

Pelvis of Moscow (median section). Instance of extreme forward displacement of fifth lumbar vertebra. (NEUGEBAUER.)

Pathology. The pathological condition is fairly constant, the degree and location varying within certain limits. The essential part of the condition seems to be the slipping forward of one of the lower lumbar vertebral bodies, while the veterbral arches

* Lancet, 1893, xxix. p. 991.

remain practically in place. This implies, of course an increase in the distance between the body and the spinous process of such a vertebra, and the cause of this elongation or division of the vertebral arch is the subject of the discussion. That this condition exists is established beyond any doubt by the specimens in the museums of Europe.

The commonest form of the displacement is subluxation of the fifth lumbar vertebra in relation to the sacrum (thirty in forty-two specimens). The displacement of the fourth lumbar vertebra in relation to the fifth is next in frequency (twelve in forty-two specimens). The displacement forward of the first sacral vertebra in relation to the rest of the sacrum* has been recorded once only

Fig. 2.

Small pelvis of Prague (median section). Instance of slight forward displacement of fifth lumbar vertebra. (Neugebauer.)

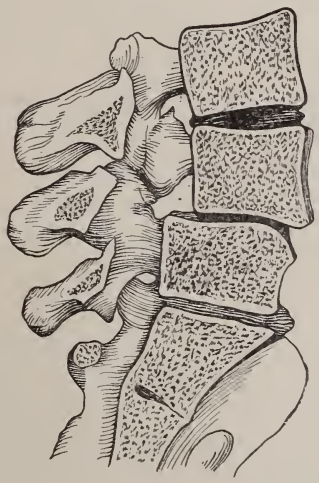
(H. von Meyer, Zurich specimen). This specimen has been spoken of as pseudo-spondylolisthesis, but the distinction seems hardly worth maintaining.

The displacement may be slight and the fifth lumbar vertebra project only slightly ahead of the sacrum† (Prague specimen) or it may be extreme and the fifth lumbar vertebra may be rotated through ninety degrees, and its lower surface in this case will lie against the front of the upper part of the sacrum (*e. g.*, Halle specimen, Moscow pelvis, see Fig. 1). Secondary changes occur in the severer cases. The displaced vertebra may become condensed

* Berlin specimen, Virchow. † Berlin specimen, Virchow.

and wedge-shaped, and pressure effects in modifying the shape of bones are also noticed in the upper part of the sacrum. Exostoses may develop about the joints of the displaced vertebræ, apparently elongating them, and the intervertebral joints may be obliterated or the fibro-cartilage may be replaced by an arthrodial joint. The intervertebral disks in the region of the deformity are changed in shape by the pressure, and at times some modification of the articular processes may result from the pressure, but these changes are not uniform. The bony arch connecting the vertebral bodies and the laminæ may, as I understand it from the literature, be either thinned and intact, or it may be separated entirely. This may be a unilateral or bilateral condition.

FIG. 3.



Breslau specimen. Instance of slight forward displacement of the fourth lumbar vertebra. (NEUGEBAUER.)

The pathological condition may be better understood by a glance at the figures than by any discussion, however lengthy. The amount of displacement obviously varies within very wide limits, and with it the clinical phenomena must vary also.

So marked a change in this region of the vertebral column, where the curve is so sharp, results, of course, in a marked disturbance of equilibrium, and the symptoms vary as the direct outcome of the mechanical condition. The posterior superior iliac spines are

more widely separated than normal in severer cases and the inclination of the pelvis is diminished (Neugebauer).

The essential point, it may be repeated, in spondylolisthesis is not so much the subluxation of the body of the vertebra as the antero-posterior elongation of the body of the lumbar vertebra. This exists always, and is apparently the pathological condition peculiar to this situation and this condition.

In comment on this it should be remembered that each vertebra develops from three centres of ossification, one for the body and one for each lamina and its processes. The vertebral arch forms during the first year by the joining of the two posterior centres of ossification, but this is not joined to the centre of ossification of the vertebral body until the third year (Gray).

The causes of separation of the anterior and posterior parts of the lumbar vertebræ are classified by Neugebauer, and generally accepted to be as follows:

I. Separation on one or both sides between the body and the laminæ of the vertebra.

(*a*) Due to a defect in development.

(*b*) Due to fracture.

II. Primary disease of the sacro-vertebral articulation.

III. Vertebral deformity, due to superimposed weight and bony changes resulting from pressure.

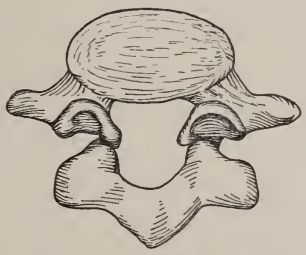
Each of these divisions will be briefly considered in turn.

I (*a*). *The Separation of the Vertebral Arch due to Congenital Defect.* Deficient union or absence of union between the vertebral laminæ and the bodies is recognized under the formidable names of spondylolysis or spondyloschisis (Lambl[6]). Such lack of union, or imperfection of union, might, under the circumstances of injury or excessive weight-bearing, predispose to spondylolisthesis. That such congenital deficiency of vertebral union is not excessively rare is shown by the statement of Neugebauer that Langer estimates this defect as occurring in 10 per cent. of skeletons, and Jendrzichinskiz in 5 per cent. Neugebauer has found two hundred and forty anatomical specimens in European museums illustrating the condition, and a good deal has been written on the subject.*

* Broca: Bull. de la Soc. d'anat. de Paris, 1884, p. 448. Treub: Nouv. arch. d'obst. et de gyn., 1889, iv. 410, with figures. Turner: Report on Human Skeletons. Challenger's Reports, xvi., 1886.

I (*b*). *Separation of the Vertebral Arch due to Fracture.* Fracture between the bodies and the laminæ of the vertebræ may occur in the lumbar vertebræ, and at first all cases of spondylolisis were described as traumatic (Howship, Bell, Otto, Mayer, etc.). Now, after cases of separation of real congenital origin have been set apart, clearly traumatic cases of fracture in this locality are also to be recognized. There are such specimens in many European

FIG. 4.



Specimen from the museum of Kölliker at Wurzburg, showing double defect in the vertebral arch. (NEUGEBAUER.)

museums. (Royal College of Surgeons, No. 433, three lumbar vertebræ. St. Thomas' Hospital, E. 27, fifth lumbar vertebra. Museum of Friedburg, N. O. II., two second lumbar vertebræ. Anatomical Museum at St. Petersburg, fracture of the fifth lumbar vertebra with callus, and others.)

Fractures located here may occur from indirect violence, by *contre-coup,* as in falls, and from hyperflexion of the trunk, as at the lower lumbar region the movable vertebral column changes to the rigid pelvis, and the mechanism of such fractures can be studied in Krukenburg,[7] Meyer,[8] Strasser,[9] Winckel,[10] and Czaussouw.[11] Apparently, from the case recorded in this paper such fractures also result from direct violence.

II. *Disease of the Sacro-vertebral Articulation.* Strasser[9] has advanced the theory that inflammation of the lumbo-sacral articulation may be the cause of the deformity. In addition to the case reported by him, a specimen in the museum of Czaussouw, at Warsaw, supports the theory that such arthritis (probably of traumatic origin) may be the cause of spondylolisthesis, not only by its own effect, but by causing secondary changes in the arches and their connection with the bodies of the vertebræ.

III. *Bony changes the Result of Pressure.* W. A. Lane[12] has advanced the theory that excessive weight-bearing and hard labor may be the cause of spondylolisthesis, and, as the result of his demonstration that continuous severe bony pressure is able to cause bone atrophy and absorption, he finds the cause of the elongation of the vertebral arch and the wedge-shaped condition of the displaced vertebræ is a mechanical result of such long-continued or excessive pressure.

By its anatomical position the body of the fifth lumbar vertebræ is likely to be pushed forward, especially if imperfectly supported by the ligaments. The relation that this pressure bears to the tendency of pregnancy to increase and at times to cause spondylolisthesis is of interest inasmuch as the pelvic articulations are softened and vulnerable during pregnancy. Lane lays the greatest stress upon hard manual labor as the causative factor.

This theory undoubtedly bears upon all cases to some extent and explains others wholly. Within certain limits it meets with almost universal acceptation. It has been elaborated at length by Lane in various papers, and his opinion as to the frequency of spondylolisthesis has been already alluded to.

Chiari* advances as a cause the abnormal development of the lumbo-sacral-joint area, and bases this on a case where he found lengthening of the lower surface of the fifth lumbar vertebra (without lengthening of the arch), thus classing it as an abnormality of development.

The development of exostoses about the articular surfaces of the displaced vertebra has been already alluded to (specimen in Neugebauer's collection, figured in book, p. 6, Fig. 1).

Other theories as to etiology may be dismissed with a mere mention as being unsupported by pathological evidence, such as Lambl's theory† that the deformity is due to fœtal hydrorrhachis, etc., that spondylolisthesis is the result of inflammatory bone disease[13] or softening of the joints.‡

* Zeitsch. f. Heilk., 1892.

† Lambl.: Cent. f. Gyn., 1881, xi. p. 25; xii. p. 28; 1885, xxiii. p. 356. Virchow's Archiv, 1857. xi. 2, 187.

‡ Bohn: Inaug. Diss., Berlin, 1892. A New Case of Spondylolisthesis, with Successful Delivery. Olshausen: (*a*) Mon. f. Geb. u. Gyn., 1861, Bd. xvii. p. 255. (*b*) Mon. f. Geb. u. Gyn., 1864, Bd. xviii. p. 190.

Causation. Spondylolisthesis is recorded as affecting women more frequently than men, and comparatively few male cases have been recorded.

It occurs almost always at puberty or in young adult life, and the majority of all cases, of whatever kind or degree, where any history is obtainable, give the account of a severe traumatism, occurring most often during childhood or near puberty. Falls from a distance, striking on the back, blows upon the lumbar region, or forced flexion of the spine, are the causes generally given. The deformity may follow immediately upon the accident, or it may develop in after years, just after puberty or during pregnancy. Other cases are to be accounted for only by frequency of pregnancy or by very hard work. Many cases are incompletely recorded, and in a few no assignable cause can be found.

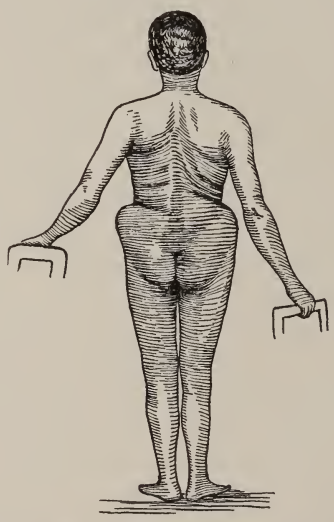
Symptoms. It is obvious on reading the literature on the subject that many cases must present trivial symptoms, for the spondylolisthesis has often been first detected in the autopsy room or upon the dissecting table, and by an inspection of the figures of the pathological specimens recorded it is evident that the degree of bony displacement varies so widely that the symptoms must needs range from a slight increase in the backward prominence of the iliac crests to a condition where the patient walks forward with a gait almost like a quadruped (see references).*

The symptoms by which the diagnosis must be made are as follows: A disturiance of equilibrium resulting in a faulty carriage, which is shown chiefly by a sharp increase in the lower lumbar curve in even the mildest cases. More exactly it seems to be a prominence of the iliac crests and buttocks in relation to the lumbar spine. There is no apparent falling away of one spinous process from another, for reasons that have been demonstrated in speaking of the pathology. The spine curves forward sharply from the sacrum, and this gives undue backward prominence to the crest of the ilium and the buttocks. The appearance at first glance is the same as that in cases of double congenital dislocation of the hip. Lateral deviation of the spine may be present, and is generally

* Paderborn case. Killian: Comment. Anat. Obst. de Spondylolisthesis, Bonn, 1853. Halle case. Olshau en: Monatschrift für Geburtshülfe und Gyn., 1861, xvii. 255; 1864, xxiii. p. 190.

indicative of a lesion more or less unilateral. Pathological examination has shown that spondylolithesis not infrequently exists only on one side; lateral deviation may, however (as in the case here reported), be only an indication of muscular irritation, similar to the lateral deviation in Pott's disease, and, as in that case, it may be temporary and disappear largely under treatment. With this lordosis goes a diminution of the obliquity of the pelvis, which

FIG. 5.



Case of spondylolisthesis. (BREISKY.) Woman thirty years old.

rotates on its transverse axis, and the pubis is higher than it should be normally, while the sacrum is lower. The combination of lordosis with diminished pelvic obliquity is said to be pathognomonic by Neugebauer. The rotation of the pelvis is an important factor in that it tightens the anterior ligaments of the hip, and thus tends to cause a flexed position of the thighs.

Vaginal examination shows, of course, a prominence high up on the posterior wall of the pelvis, and the obstetrical side of this aspect of the question has been elaborated with the greatest thoroughness and by the most careful measurements. The trunk is shortened in relation to the legs, on inspection, even in such mild cases as the one recorded, and the thorax tends to approach the

pelvis. In the severer cases the distance between the ensiform cartilage and the pubes is surprisingly diminished. In the severer cases lateral folds of the skin in the back or abdomen are likely to appear.

The gait in spondylolisthesis is said by Neugebauer to be modified in a characteristic way, and by tracings taken he has apparently demonstrated that the footprints resemble those of a normal woman at the end of her pregnancy. The footprints in severer cases show marked eversion of the feet; but what is more characteristic is that the prints of the right and left foot in progression lie more nearly ahead of each other than is normal, and a straight line passes

FIG. 6.

Case of spondylolisthesis. Woman thirty-six years old. Hard work, but no severe trauma. Rear view. (BRAUN VON FERNWALD.)

FIG. 7.

Side view of same case as Fig. 6. (BRAUN VON FERNWALD)

through the heel prints of both right and left foot, which is not the case in the normal foot. Braun von Fernwald, however, failed to confirm Neugebauer's observations in this regard, and the question still remains open, but it would seem that any abnormity of this sort must vary so much in proportion to the degree of pain and deformity that the diagnostic value must be slight.*

* Arch. für Gyn., 1896, p. 126.

Pain and stiffness, of course, follow the accident, and nervous disturbances of the legs and feet, varying from those of slight degree to complete paralysis, may be present. The affection is not, however, one characterized by excessive pain.

The chief signs by which diagnosis is to be made are evidently an increased lumbar lordosis occurring in connection with pregnancy or a fall; a disturbance of the relation in the spines of the lumbar vertebræ to the crests of the ilium; shortening of the trunk; a disturbance of equilibrium resulting from the distortion; generally some scoliosis, and often some inability to extend the legs fully.

The differential diagnosis must be made from Pott's disease, double congenital dislocation of the hip, and rickets. Pott's disease offers the greatest difficulty, and exclusion of it must be made on general diagnostic points.

In the case here recorded the gait and the general symptoms at first were strongly suggestive of lower lumbar Pott's disease, but this failed to explain the attitude, the shortening of the trunk, the flexion of the thighs, and the peculiar lordosis.

The absence of a knuckle or a rigid area in the upper spine, along with a deformity not accounted for by softening of the bodies of the lumbar vertebræ, would generally serve to make this clear. Such immediate and permanent improvement resulting from fixation as occurred here is not, as a rule, consistent with the existence of tuberculous diseases of the bodies of the lumbar vertebræ.

Double congenital dislocation of the hips is easily excluded by finding the trochanters on Nélaton's line and the history of the case, where it is obtainable.

Rickets must be recognized by its general diagnostic signs. In rickets the pelvic inclination is increased, and in any case so severe as to produce a very marked lordosis other characteristic signs must be found.

Treatment. So far as can be judged from the case here recorded, and from the few cases considered, from a surgical aspect the most successful treatment consists in fixation of the lower spine by a jacket or brace until the fracture, if such has occurred, has united and the products of the injury have been absorbed; or, if heavy weight-bearing has been the cause, until the stretched and weakened

tissues have resumed as normal a position as possible. This period must, of course, last for months, or in cases of great deformity it would seem as if a fixation support must be permanent. Generalizations from one case are of little value, but in the case recorded the greatest benefit was found at once from the application of a plaster jacket. Laminectomy, as demonstrated by the case of Mr. Lane, is an operation to be considered where symptoms of bony pressure are present for any length of time. He found, however, the greatest difficulty in removing the lamina, which was in this case somewhat displaced forward. On opening the spinal canal it was evident that bony pressure existed by the bulging of the compressed parts. In Gibney's case an unsuccessful attempt was made to reduce the deformity under ether.

[NOTE.—A complete index of literature previous to 1890 is to be found in Neugebauer's monograph, *Spondolisthésis et Spondylizéme*, Paris, 1892, G. Steinheil, editeur.]

William C., eighteen years old, a young man at school, was referred to me on September 5, 1896, by Dr. J. E. Garland, of Gloucester. He had always been fairly well except as a baby, when he had been sickly, with no especial disease. Later he grew strong, and as a boy and young man was free from all disability, athletic, well developed, and of good physique. There was nothing unusual about his figure. He was straight and square, and able to do as much or more than other boys.

On April 3, 1896, he was helping about a stable and was leading a harnessed horse, which was attached to a heavy wagon; the horse took fright at something and became unmanageable; the young man lost his hold, the horse ran away, and both wheels of the wagon, weighing twenty-six hundred pounds, passed over his pelvis.

The patient suffered much pain; he found that he could not bear any weight on his feet, nor could he sit down. He was carried home, and, as I understand it, had no medical attendance. He had no passage of blood from the urethra or rectum, and was only confined in bed for a week or so. At the end of that time his family got him crutches, and he went around more or less, although he suffered a good deal of pain, mostly in his legs and a little in his back.

When he came to see me he walked very badly, bent forward, and leaned well over to the right. There was marked limitation of motion in the lumbar region of the spine, and when he lay on his back the knees could not be touched to the table.

On inspection he was found to be a well-developed young man, standing bent over forward and to the right. Movement in all directions was attended by much pain, and he looked somewhat worn and white from the long disability.

Fig. 8.

The knee reflexes were normal, and there was no disturbance of sensation in the feet or legs. The bladder and rectum were normal. His general aspect, so far as movement went, was that of a case of severe lumbar Pott's disease and psoas abscess.

What attracted my attention was the sharp prominence of the iliac bones backward, the very marked lordosis in the lumbar region, and the shortening of the trunk. The shape of the hips was strongly suggestive of double congenital hip dislocation, but the trochanters were on Nélaton's line.

It could easily be felt in examining the spine that between the sacrum and the lumbar spine there was a sharp difference, the lumbar spine being further forward than it should be and the upper part of the sacrum apparently being in the normal place.

The provisional diagnosis of spondylolisthesis was made, and, as it was evident that there was much pain in motion and that the vertebral articulations were in a state of much irritability, a plaster jacket was advised and was applied under suspension. On being let down on to his feet the patient stood better and experienced a feeling of relief.

He returned at intervals of two months for jackets, and in February, 1897, was given a laced jacket and told to remove it at night.

On April 22, 1897 (a year after the accident), he was again examined and was discharged from treatment, as all symptoms of irritation had disappeared. The lateral curvature, as can be seen from the picture, had almost entirely disappeared. The left crest of the ilium is a little more prominent than the other. The deformity of the lumbar spine remains, but is apparently less marked than before.

Lateral flexion of the trunk with the arms behind the head is not normal, but perhaps to within two-thirds of the normal limit.

In standing with knees straight he can bend over until the tips of his fingers are twenty inches from the floor. No motions are painful.

With the pelvis flexed and the arms behind the head right and left torsion of the trunk are about one-half of normal. He can lie on a table and touch both knees without arching the spine. The walk is not perceptibly bad with the clothes on, and there is absolutely no pain.

He is able to go without the jacket a good part of the day, and expressed himself as conscious of no disability from the accident.

The case is reported at some length, as I was at a loss to know

on what line to proceed. As the symptoms presented were very much like those in lumbar Pott's disease, it seemed to me best to quiet any irritation which might exist there, and this I did by the plaster-of-Paris jacket, as it offered the most perfect fixation.

I gave, however, a very guarded prognnosis, thinking that permanent disability would result, and I was very much surprised at the good recovery on fixation and the disappearance of notable disability, although the characteristic deformity was but little diminished.

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DISCUSSION.

DR. NEWTON M. SHAFFER, of New York, said that he had seen one case closely resembling that described, so far as the condition of the spine was concerned. He had also seen other cases closely resembling it as regards the condition of the hip. One case was that of a girl, aged twelve years, who entered St. Luke's Hospital with a diagnosis of dislocation of the hip. The abduction and rotation were so great as to lead to this diagnosis. The extreme malposition of the hip was very remarkable. Under ether the parts could be immediately placed in position, and the diagnosis was then changed to hip-joint disease. This diagnosis was subsequently confirmed, and the case ran an acute course, with the development of abscess. In another case there was extreme lordosis of the spine, with an apparent dropping away of the spine from the sacrum. There was, however, no history of traumatism, but only of Pott's disease. In that case the patient recovered with a position similar to that shown in the photographs of Dr. Lovett's case. He was of the opinion that in this case there had been a lesion between the last lumbar vertebra and the sacrum—an inflammatory condition with such marked lordosis as to suggest the diagnosis of dislocation. The result of treatment seemed to confirm this view.

The President referred to a case exemplifying the fact that sometimes cases present marked symptoms during life, as in Dr. Gillette's case, and yet show comparatively little on post-mortem examination. The case was that of a young lady who had a well-marked protrusion of the dorsal portion of the spine, with complete paraplegia of the lower extremities, and, at one time, paraplegia of the arms. She recovered from the latter, but never from the paraplegia of the lower extremities. The girl had come to him originally as a case of round shoulders. The paraplegia developed about six months after treatment had been begun with an antero-posterior apparatus. After having been on a water-bed for two years she died of exhaustion. The post-mortem examination was made by Dr. T. H. Myers. No lesion of any kind was found in any of the vertebræ. The pathologist who had charge of the examination of the spinal cord never reported upon it. No organic lesions were found, and yet those who saw the case during life felt convinced that it was neither a case of hysteria nor of malingering.

Dr. William J. Taylor, of Philadelphia, recalled an operation on a case of supposed spinal tumor in which no disease of the vertebræ was found. The whole of the central portion of the cord was diseased, although there was no thickening of the cord itself.

Dr. Shaffer said that he had had a patient with Pott's disease whom he had followed from the age of six years to that of twenty-five years. This man occasionally had a cough and some lung irritation, and he discharged through the mouth, on coughing, small spiculæ of the cancellous structure of the vertebræ. This showed that it was possible for an abscess to penetrate the pleura and lung without producing any extensive disturbance. This individual had been examined several times by Dr. A. H. Smith, who had found only very slight disturbance of the lung.

A CASE OF ASYMMETRICAL DEVELOPMENT.

By A. R. SHANDS, M.D.,
WASHINGTON, D. C.

The case here presented is an example of this unusual condition, which occurred in a boy, aged twelve years. The circumference of the right calf at its middle was 15 inches, and that of the left, $9\frac{1}{2}$ inches; the circumference of the right thigh was $18\frac{1}{2}$ inches, and that of the left thigh, 13 inches; the length of the right and left legs was $28\frac{1}{2}$ and $24\frac{1}{2}$ inches respectively; the circumference of the right forearm measured 8, and the left, $7\frac{1}{2}$ inches; the circumference of the right little finger was $2\frac{1}{4}$ and that of the left, $1\frac{1}{2}$ inches. Strangely enough, the large thumb was on the small side of the body. There was a marked difference in the size of the two ears. The lower extremity on the large, or right, side was covered with purplish blotches, which were said to have been noticed at birth. The child had a peculiar, husky voice. His intelligence was up to the average.

DISCUSSION.

Dr. A. Jacobi, of New York, was invited to express his views of the case. He said that it had been orignally an example of that very rare conditon—unequal development of the two sides. It would be noticed that the cranium was asymmetrically developed and that the angle of the lower jaw was of a different size and at a different level on the two sides. He had seen only two other very marked cases of this kind. One of these was seen by him nearly thirty years ago and when the differences in the two sides was quite slight. He had seen the patient again—a year and a half afterward—and there had been a much greater difference then in the

development of the two sides—the lower extremity exhibited a difference of several inches. Another case, not so marked, had come under his observation a few years ago. The present one was the third case. It could not be classed as an example of acromegaly, though the size of the feet suggested it, for that was not a unilateral disorder. There could be no doubt that the bloodvessels in the large side were abnormal in size, number, and distribution, just as they were in the skin, where they gave rise to the purplish blotches. The immense swelling of the right lower extremity was explained by the telangiectatic conditon of the bloodvessels and the development, probably, of connective tissue which is apt to accompany sluggish circulation. Undoubtedly, a good deal of the apparent difference in the development of the two sides was due to the presence of œdema and fat. The genital organs were rather poorly developed for a boy of this age, and the testicles had not yet descended. One testicle was to be felt just emerging from the inguinal ring.

Dr. I. Adler, of New York, was invited to participate in the discussion of this case. He said that this made the fourth case coming under his observation, although the condition was certainly very rare. Only recently he had seen a case in which there was unilateral hypertrophy confined to the lower extremity. These cases were of interest from a pathological and a diagnostic point of view. They were dependent probably upon irregularites in development occurring at a very early period of intra-uterine gestation. In the diagnosis one would have to consider acromegaly, general hypertrophy, or "giant growth," liver-tissue ossea, general hyperostosis and elephantiasis. Acromegaly could be excluded because this condition did not occur unilaterally, yet he had been impressed in the present case by the fact that the thumb on the small side was quite large. It would be interesting if in the future the boy should develop, in addition to giant growth, an acromegaly. As acromegaly was a disease of later life, continued observation for a considerable period would be required. Elephantiasis could be dismissed because, so far as we know, it was a hypertrophy of the soft tissues only, whereas in this case there was hypertrophy of the bone also, as shown in the bones of the right foot, thigh, and leg.

Another characteristic of giant growth was the large part which the vascular system played in this malformation. The bloodvessels were always very much enlarged—not only the larger arteries and veins, but also the capillaries. Microscopical examination would show the capillaries, both of the soft parts and of the bone, immensely enlarged. It was quite rare, however, for the capillaries of the skin to be involved, and it was, therefore, interesting to note that in this case these capillaries were involved, as shown by the large "port-wine marks." Of course, the etiology was not yet known, and but few pathological and microscopical researches had been made. It had been suggested that in the early embryonal period, probably as a consequence of a disturbance in development, of a neurotic or cerebral character, there might be produced vascular irregularities, and that these might be responsible for irregularities in growth in later life. It was worthy of note that hypertrophies of bone were known to take place even later in life. It has been proven experimentally that the "drumstick" fingers in phthisis, and various other wasting diseases, were caused by abnormal products of metabolism. Some such condition might even be responsible for some of the remarkable changes observed in this case. It would be interesting to have careful analyses made of the secretions for a considerable period in a case of this kind.

SOME EFFECTS UPON THE LEG OF PRONATION OF THE FOOT.

By JOHN DANE, M.D.,
BOSTON.

During the past few years a large amount of attention has been given to the study of the foot. Its anatomy has been most accurately described in every detail; and the changes in form which it undergoes when subjected to weight have been the subject of almost endless experiment and examination. It is not the purpose of the present paper to discuss points that have been so amply gone over before, but rather to call to your attention some few facts concerning the behavior of the leg which are induced by that series of changes in the shape and position of the foot which have of late been referred to as "excessive pronation."[1] So intently has the attention been fixed in this study upon the behavior of the foot itself that very little has been said or thought about its relations to the leg other than that of the point of projection of the centre of weight-bearing as it is seen to move inward with increasing eversion of the sole. In fact, it is the all but universal custom in our descriptions to regard the leg as the fixed point and to speak of the various movements of the foot in their relation to that. However true this may be of the foot when hanging freely in the air, it certainly ceases to be so as soon as the foot is placed upon the ground. From the moment that the weight of the body is thrown upon a foot, the sole of which is resting upon a relatively even surface, the greater part of that foot is thereby anchored and

[1] "The Affections of the Arch of the Foot, commonly Classified as Flat-foot." Lovett and Dane: New York Medical Journal, March 7, 1896.

becomes the fixed point. The change in relative positions which we commonly refer to as "abduction of the foot," is, as far as motion is concerned, really "adduction of the leg," and so on throughout the list.

That the foot was really the fixed point was first brought forcibly to the attention of the writer by a study of some photographs, taken with double exposures upon the same plate, made when preparing a joint paper with Dr. Lovett, which was read before this Association two years ago.[1] In such pictures it can be seen at a glance that while the double outline from the malleoli upward shows a change of position of the leg, the toes and the greater part of the foot must have remained absolutely stationary. In a later paper[2] Dr. Lovett emphasizes this fact when he says: "The toes remain practically stationary, while the whole leg rotates inward at the hip," and he has made excellent use of this fact in his construction of a triangle for measuring the amount of "rotation" the angles of which are respectively the external malleolus, the cleft between the third and fourth toes, and the internal malleolus. Still later Dr. James S. Stone, in his paper read at the annual meeting of the Massachusetts Medical Society, June, 1896,[3] has carried the idea further than anyone else when he says: "Pains in the calf are usually due to muscular strain, while those in the knee or hip may be explained by the rotation of the whole limb, due to the impossibility of any rotation of the astragalus between the two malleoli."

In speaking of the changes brought about in the relations of the ankle-joint by pronation of the foot, all discussion as to the exact seat of pronation is, for the sake of simplicity, purposely avoided. The changes in position of the malleoli are regarded simply as the result of series of changes taking place between them and the astragalus, between the astragalus and the os calcis, and along the line of the middorsal joint of the foot. The ankle-joint proper, formed by the gripping of the articular surfaces of the astragalus between the malleolar extensions of the tibia and the

[1] "The Affections of the Arch of the Foot," etc. TRANSACTIONS OF THE AMERICAN ORTHOPEDIC ASSOCIATION, vol. viii., p. 78.

[2] "The Mechanics and Treatment of the Broken-down Foot." New York Medical Journal, June 20, 1896.

[3] "The Treatment of Flat-foot." Boston Medical and Surgical Journal, June 14, 1897.

fibula, one on either side, is so constructed that it allows of flexion and extension, and practically nothing else. This purely hinge-motion takes place about a line drawn between the central points of the two malleoli or very near to it. But as the central point of the external malleolus is situated not only in a lower horizontal plane than the corresponding point of the internal malleolus, but also lies more posteriorly, it follows that the plane of the hinge of the joint varies from that of a right angle to the long axis of the leg in two ways. Just what this variation is has not been very accurately stated, either in the text-books or special monographs. Walshan and Hughes[1] refer to it thus: "When standing with the foot at a right angle to the leg the straight line joining the centre of the two malleoli lies in a plane directed forward and outward." Quain[2] speaks of it as the "obliquity of the ankle-joint, which forms with its fellow, owing to the outward direction of the foot, an angle, open backward of about 130 degrees."

With the view of determining this with a little more exactness, a set of measures was made upon the feet of adults and older children; the best feet obtainable being used. With the subject in the standing posture, the bare foot was placed upon a piece of cardboard and just enough weight thrown upon it to keep it steady. Its outline was then traced with a pencil, held by means of a special apparatus, at a right angle to the floor. Upon this outline the vertical projection of the central point of each malleolus was marked. Lastly, these marked points were connected upon the cardboard by a straight line. The angle of divergence of this line to another drawn parallel to the long axis of the os calcis was then measured. This it was assumed gave the obliquity of the hinge of the ankle-joint in a horizontal plane. This was found to average between 84° and 85°; or taking the two feet together, an angle open backward of 169°. (See Fig. 1.)

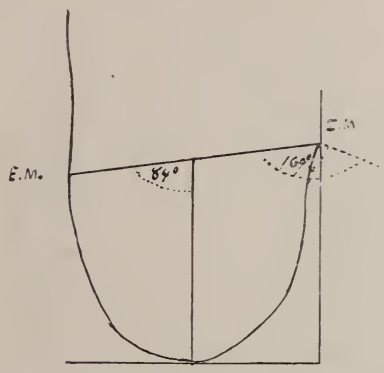
The angle of obliquity in a vertical plane was found by measuring the height from the floor to the central point of each malleolus; also the distance from centre to centre as measured by compasses. These points having been plotted upon paper and connected with a straight line, the angle of divergence of this line from the perpen-

[1] "Deformities of the Human Foot," p. 24.
[2] "Quain's Anatomy," tenth edition, vol. ii., p. 192.

dicular was easily measured. This was found to average about 77°; or, taking the two joints together, an angle open downward of 154°. (See Fig. 2.)

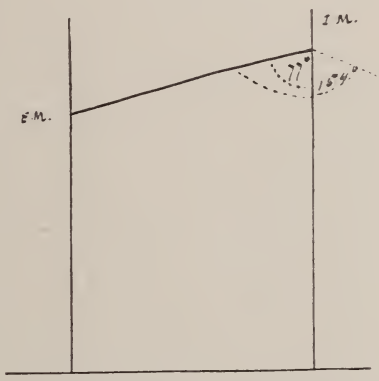
The next question is: What is the behavior of the malleoli, comprehending as they do between them the plane of the ankle-joint, when weight is thrown upon the normal foot? Fortunately this question has been investigated in the most careful manner by Gole-

FIG. 1.



Showing obliquity of the normal ankle-joint in the horizontal plane.

FIG. 2.



Showing obliquity of the normal ankle-joint in the vertical plane.

biewski.[1] His method was to take a series of accurate plaster casts of the feet in various positions and under varying amounts of weight, and on these casts to make careful measurements of the relations of selected and marked points. His conclusion is[2] that "When one so holds himself as to stand upright and the foot makes a right angle with the lower leg, then the tibia again makes a small outward rotation, whereby the internal malleolus must again move forward and the external backward." His actual figures as far as the present inquiry is concerned may be abbreviated and put in tabular form thus. They are somewhat confusing, however, from the difference in the two feet, that for the left being used here as that is apparently the one from which he draws his conclusions:

[1] Golebiewski: Zeitschr. fur Orthopadische Chirurgie, B. iii., s. 243.
[2] Op. cit., s. 246.

Measurements in millimetres.		Downward.	Forward.	Backward.
Internal malleolus	with body weight	4	3.5	
	" " " + 50 kg.	6	4.5	
External malleolus	with body weight	7	.....	1
	" " " + 50 kg.	11	.....	4
Tuberosity of scaphoid	with body weight	5		
	" " " + 50 kg.	6.5		
Tuberosity of 5th metatarsal	with body weight	17		
	" " " + 50 kg.	20		

These figures show that when the foot is subjected to weight the external foot-arch descends much more than does the internal; and the external malleolus drops downward farther than does the internal malleolus. The result of this relatively greater descent of the outer end of the hinge of motion of the ankle-joint is an increase in its obliquity as regards the perpendicular. But what is of even more importance for our present inquiry is the backward rotation of the external malleolus and the forward rotation of the internal. This alters in a second way the line of flexion of the joint and increases its outward obliquity in a horizontal plane.

To understand the significance of these changes as well as those that take place in the pronated foot, it is necessary to consider the mechanism by which the weight of the body is made to assist so greatly in maintaining the erect attitude, that practically we are enabled to stand without much muscular exertion. These theories were first brought forward by Prof. Meyer, of Zurich, and have since been elaborated in his many publications.[1] He has shown that when standing in the erect position the weight of the trunk and upper extremities is transmitted downward in a line that falls behind the centre of motion of the hip-joints. The tendency, therefore, is for the pelvis to "fall backward by over-extension of the hips;" but this tendency is met after a slight amount of motion, by tension on the extremely resistant anterior portion of the joint-capsule known as the ilio-femoral ligament. The strength of this ligament is more than sufficient to hold the joint locked. This mechanism enables the thigh bones to support the weight of

[1] H. von Meyer, Muller's Archiv., 1853, s. 32, u. s. 500. His und Braune's Archiv., 1880, s. 289 ff. Statik und Mechanic des Menschlichen Fusses, June, 1886.

the trunk when in this position, in great measure without muscular exertion and its consequent fatigue. All other positions, necessitating, as they must, a much greater muscular effort to maintain them, very soon become tiresome. In this connection it is important to note that, owing to the partially oblique course of the iliofemoral ligament, tension upon it will result in a slight inward rotation of the thigh, the significance of which will be considered later.

The tilting backward of the pelvis, with its consequent raising of the anterior-superior spines and adjacent parts of the iliac crests, not only serves in the way just pointed out to lock the hip-joints, but it plays a most important part in preventing flexion of knees as well. The line of weight is transmitted downward by the thighs, behind the axis of motion of the knee-joints, which must for security in standing be locked in extreme extension. As described by Quain,[1] the knee "is not exactly a hinge-joint, and extension and flexion . . . are produced by a combination of gliding, rolling, and rotation . . . In the movement of extension the condyles move parallel to one another, both gliding and rolling until extension is nearly completed, and then, the anterior part of the rolling surface of the external condyle having already come into full contact with the tibia, the inner condyle continues to glide backward, bringing its oblique anterior part into contact with the tibia, so that the femur is rotated inward on the tibia. Similarly, the beginning of flexion is accompanied by a rotation outward of the femur or inward of the tibia." That is to say, the knee-joint is finally, as it were, locked in complete extension by a rotatory twist, which must be overcome before flexion is possible. The anatomical construction of the joint itself causes this twist as it approaches complete extension, but the structures on the outer side of the leg are of great assistance in maintaining it. Connecting the outer tuberosity of the tibia and the anterior part of the iliac crest is that dense thickening of the fascia lata, known as the iliatibial band, reinforced by the tensor vaginæ femoris and biceps muscles. When, as already described, the anterior part of the iliac crest is raised by a tilting backward of the pelvis, these struc-

[1] "Quain's Anatomy," tenth edition, vol. ii., p. 188.

tures are put upon the stretch. The result is not only a still firmer pressing together of the joint-surfaces at the knee, but a powerful check to any inward rotation of the tibia—a check so effective that it must be overcome by tilting the pelvis forward or flexing the hip-joints before the knee-joint can be unlocked enough to allow flexion there.

In the ankle-joint the problem of supporting the body-weight with a minimum of muscular exertion differs in many ways from that in the hip and knee. Here the position to be maintained is one midway between flexion and extension, therefore a locking of the joint at one limit of its arc of motion is out of the question. As we stand in the upright position the line of weight falls in front of the axis of motion of the ankle-joint. The constant tendency is, therefore, for the tibia and fibula to fall forward; the resulting motion being generally referred to as "dorsal flexion of the foot." The mechanism which prevents this flexion is in large measure dependent upon the obliquity of the line of motion of the ankle-joints. This obliquity, which we turned aside to consider in the early part of this paper, amounted to an angle open backward of 169°, and downward of 154°, when the two joints are considered together. Were the axes of motion of the ankle-joints set at a right angle to the long axis of the legs, it is easy to see that there would be no impediment to the two legs falling forward parallel to each other, even with the knees fully extended. Not so in the case of the normal foot; for, owing to the marked obliquity of its axis of motion, a new factor is at once added. In order to flex two such joints simultaneously, it would be necessary either to carry the heads of the femora in opposite directions, which is a manifest impossibility, or to flex the knees, which is precluded by the mechanism that we have just been considering. The result is, therefore, a comparatively stable ankle-joint even in a midway position of its arc of motion. It remains, in passing, but to add that the outward rotation of the tibia and fibula, that we saw was an accompaniment of the final act of extending the knee, is such as to make the ankle-joint still more oblique, and consequently still more stable when called upon to support the body-weight.

Turning now from the normal to the pronated foot we shall find that the conditions are altered in just such a way as to hamper, if

not to render impossible, the working of the entire mechanism that we have just been considering. To study the behavior of the lower

Fig. 3.

Fig. 4.

Fig. 5.

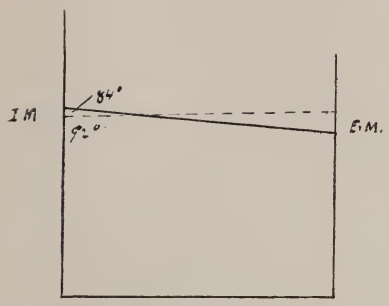
extremity as altered by pronation of the foot, the method of double exposures upon a photographic plate was used in the manner already described, but further modified by reducing the markings upon the skin to a set of fine dots, and placing a measure in the same antero-posterior plane as the marked points. With the aid of a pair

Fig. 6.

Fig. 7.

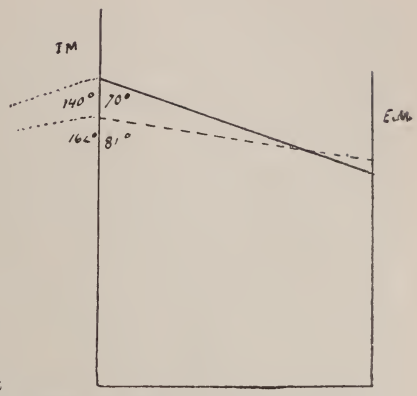
of callipers it was easy upon such a plate to measure the actual distances moved by any one of the marked points, and then to translate it into terms of millimetres. The results are given for the feet shown in Figs. 3, 4, 5, 6, and 7, in the following table. The alteration in the obliquity of the hinge of the joint when supporting the body-weight is shown by the dotted lines in Fig. 8 for the horizontal alterations, and Fig. 9 for the vertical :

FIG. 8.



Showing alteration in hinge of ankle-joint under weight in horizontal plane. (The upper angle here should read 82° not 84°.)

FIG. 9.



Showing alteration of hinge of ankle-joint under weight in vertical plane.

Measurements in millimetres.	Model.	Upward.	Downward.	Inward.	Backward.	Forward.
Tuberosity of tibia	1	...	2	13		
	2	...	3	18		
Middle of shaft of tibia	1	...	3	17		
	2	...	3	16		
Lower edge of tibia	1	...	5	23		
	2	...	3	15		
Internal malleolus	1	...	9	20	2	
	2	...	5	11	2	
External malleolus	1	4	...	16	...	9
	2	...	..	9	...	7
Head of fibula	1	...	...	...	...	15
	2	...	4	...	...	15
Internal condyle tibia	1	...	3	...	3	
	2	...	2	...	2	
Tuberosity of scaphoid	1	...	11	...		
	2	...	11	...		
Tuberosity of the 5th metatarsal	1	7	...	...		
	2	5	...	...		
Middle of shaft of femur	2	...	2	20		
Great trochanter of femur	2	...	4	...	...	20
Inside of upper thigh	2	...	2	...	1	

Angle of plane of joint to perpendicular without weight . . . 70°
" " " " with " . . . 81
" " " long axis foot without " . . . 82
" " " " " " with " . . . 92
Alteration in plane of joint under weight vertically 11
" " " " " horizontally 10

Figures 3, 4, and 5 are model No. 1. Figures 6 and 7 are model No. 2.

From these figures we see that the behavior of the pronated foot differs sharply from that of the normal foot under like circumstances. Owing to a transference of the centre of weight-bearing inward, it is the internal arch of the foot that descends the more; indeed, the external arch actually rises. This causes a vertical lowering of the internal malleolus and a rising of the external malleolus; whereas in the normal foot the external malleolus should show the greater fall. The effect of this movement upon the ankle-joint is easy to appreciate; it changes the normal outward obliquity of the axis of motion to a direction much more nearly horizontal. Such a joint offers distinctly less obstacle to a falling forward of the tibia and fibula under the pressure of the body-weight.

Added to this there is a rotatory twist of both bones of the lower leg in what may be called the wrong direction. Instead of remaining stationary or rotating very slightly outward so as, by complementing the inward rotation of the femur, to make the locking of the knee-joint still more secure, we see here a slight backward movement of the internal malleolus and a much more marked forward movement of the external malleolus. Meanwhile the head of the tibia is seen to have moved very little, but the head of the fibula has made a large excursion forward. Taken as a whole, this shows a complicated inward rotation of both bones of the lower leg about an oblique axis which passes through the inner border of the internal condyle of the tibia and just to the median side of the internal malleolus.

The results of these movements are many: First, the horizontal plane of the ankle-joint no longer looks outward, as it should, but looks slightly inward, thus still further doing away with the mechanism which renders the joint stable under weight, and throwing still more work upon the muscles. Next, by the forward and inward movement of the external malleolus the action of the peroneus longus muscle is much interfered with, and its origin and insertion are brought nearer together. As a consequence, it is contracted, and, owing to repeated strain due to its shortening, we find markedly sensitive points at its origin and the place where its tendon winds over the outer edge of the cuboid. As regards the knee, this inward, or reversed, rotation of the tibia and fibula tends to destroy the whole so-called "final rotation mechanism" by

which the joint should be locked when brought to complete extension. From their efforts to prevent as much as possible this inversed rotation of the lower part of the leg, we find the tensor vaginæ femoris and biceps muscles to have been much overtaxed. Together with the ilio-tibial band, which has suffered in the same way, they are generally swollen and tender upon pressure or exercise. In the thigh, as shown by the movement of the marked points on the skin, the normal inward rotation of the femur has been increased, in order, it would seem, to try and counterbalance the inversed rotation of the lower segment. The consequence of this is an undue strain upon all the external rotators of the hip and an irritation of the sacral nerves, thus explaining the state of tenderness and the tonic contraction so frequently found in the gluteal group of muscles, without any reference to so-called "reflex spasm" coming directly from the foot.

SUMMARY. 1. In "pronation of the foot" the greater part of the foot remains stationary and the leg rotates upon it.

2. In addition to the generally recognized motion of the malleoli inward and slightly downward, the normal outward rotation of the tibia and fibula is replaced by an exaggerated rotation inward, which takes place about a nearly vertical axis located near the inner border of the tibia.

3. These changes acting together produce an alteration in the obliquity of the axis of flexion of the ankle-joints sufficient to destroy the mechanism by which the normal joints are enabled to support the body-weight with a minimum of muscular exertion. As a consequence, flexion must be prevented and equilibrium maintained wholly by muscular force, which soon leads to irritation and fatigue of all the muscles of the lower leg, and especially the peroneus longus.

4. This inversed rotation of the tibia interferes to a great extent with the operation of the mechanism by which complete extension of the knee should lock the joint and render it proof against the constant tendency of the body-weight to flex it. The knee must, therefore, in subjects with pronated feet, be kept in extension by a constant exercise of muscular force which results in the fatigue and tendency to tonic spasm of the muscles of the thigh. This is shown also by the extreme tenderness often found over the point of

insertion of the internal hamstring muscles on the inner tuberosity of the tibia.

5. Owing to the constant attempt of the muscles on the outer side of the thigh to prevent the internal rotation of the lower part of the leg they are commonly found to be tense and sensitive to pressure.

6. To try and compensate for this inversed rotation of the tibia and fibula there is an exaggerated inward rotation of the femur. This in its turn overstretches the external rotators of the hip, as shown by sensitiveness to pressure and tonic spasm of the glutei, and tenderness over the points of exit of the sacral nerves.

7. Lastly, this explanation is wholly in accord with the clinical fact that when we have by means of efficient mechanical support, prevented "pronation of the foot," we have relieved the pains in the calf, the knee, and the hip.

DISCUSSION.

Dr. Lovett said that it seemed to him that we must work along the line indicated in the paper in the elucidation of the disorders of the feet. The time for accurate measurements and studies has arrived. We were all familiar with the backache and knee disability following certain cases of pronated feet, or flat-feet, and this paper explained why these difficulties arose.

Regarding the behavior of the back in pronation of the foot, the speaker said he had been studying the "base position" in the Ling system of gymnastics. Was it proper for a patient to assume the angle of divergence of 90°? The Swedish system was the outcome of military drill, and the object of that position was probably to produce the "flat-back." He had taken a composite photograph showing that the lordosis was much more marked when the feet were close together. If the feet were placed upon a glass plate and then observed, it would be found that with the feet parallel the weight was borne more on the outside of the foot—that in the normal position the mechanism of weight-bearing came upon the third metatarsal more than if the feet were divergent. If a person

stood with the feet divergent, and the feet were then examined through the glass, it would be found that the outer border was apt to touch the ground, and that most of the weight was under the third metatarsal. If the feet were turned out to 90°, the weight-bearing surface moved inward, and the end of the first metatarsal took a much larger share of the pressure. This position was one which tended to produce the pronated foot. The weaker the feet the more marked was this change in the pressure-surface of the foot, as seen through the glass. It also caused increased lordosis of the spine. This furnished, he thought, a fair criticism of the base position in gymnastics. It was a question whether the base position should not be one in which the feet were slightly apart, but parallel. The relation of the pronated foot to the back he believed to be a subject worthy of careful study and consideration.

The speaker referred, also, to the relation of pronated feet to beginning lateral curvature. To appreciate this one had only to strip a bad case of pronated feet, occurring in a girl of ten or fifteen years, and notice the attitude of weakness in the spine, the kyphosis in the dorsal region, the round shoulders, the compensatory lordosis in the lumbar region, and the tendency to lateral deviation of the spine in one or the other direction. The paper just presented was of value not only because of its anatomical studies, but because it showed the relation of pronated feet to other deformities of the spine and to the body in general. It pointed out the necessity for wider study of the subject of pronated feet as affecting faulty attitude and carriage and imperfect development.

Dr. Shaffer said that the paper had thrown some light on the problems that he had been studying for some time. Given a perfect mechanism and a normal condition, what was it that threw the mechanism out of gear? The demonstration just given seemed to him to tell how some things occurred with reference to the pronation of the foot and other things, but it did not tell us "why." With a perfect mechanism we were not likely to have flat-foot; with an imperfect mechanism we were liable to have it. He wished to be placed on record as saying that it was very exceptional to find a case of flat-foot that had not a shortened gastrocnemius muscle. He could see how, starting with a defective

mechanism of the foot, the very things described by Dr. Dane could have their origin in a faulty mechanism of the foot. He would regard the alteration in the external and internal malleoli and in the transverse plane as being due to some fault in the mechanism of the foot. In the great majority of cases, if not in all, the fault was to be found in a shortened gastrocnemius, which did not allow of the normal antero-posterior motion. He was now making some studies in this direction, and hoped to demonstrate his views in the future.

Dr. Dane, in closing, said that he had not considered the etiology of flat-foot at all, intending only to demonstrate anatomically that these changes in the foot, at or below the malleoli, were sufficient to cause all the trouble in the leg.

LATE EXCISION OF THE HIP.

By ROBERT W. LOVETT, M.D.,
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An article dealing with excision of the hip need no longer begin by a comparison of the merits of excision and conservatism as routine methods of treatment. Whatever the sentiment of the surgical world may have been ten or fifteen years ago, it is now generally admitted that on the whole, conservatism is preferable to operative measures. This view is supported by the weight of surgical opinion in America, in England, in Belgium, and France, and even in Germany. Certain radical surgeons who regard tuberculosis as a malignant affection still advise early and radical measures whenever a tuberculous focus appears in a hip-joint, and especially if suppuration occurs[1] (Bradley, Steiner, Cazin, Daniel, Molliere, Wright, Barker).

But if there is agreement to the advisability of conservatism on general grounds, there are often many differences of opinion expressed as to the time when conservative should yield to operative measures. The opinion of the surgical world in this regard is of interest.

In France, Ollier[2] seems to dictate surgical opinion in this matter. He writes: "Abscesses are opened; but if they recur, if they are accompanied by phenomena of absorption, if the hip remains painful and does not tend to anchylosis, if the acetabulum is diseased, resection is formally indicated."

One may assume that Vincent, of Lyons,[3] is a fair exponent of this policy, to which he agrees in his writings; and it is interesting to note that in 233 cases of hip disease treated at the Charité Hos-

[1] Gangolphe: Maladies infect. et parasit. des Os, 1894, p. 332.
[2] Ollier: Resections des Grands Articulations, Paris, 1895.
[3] Congrès de Chir. Proc. verbale, 481.

pital, where this policy was followed, 52 were resected, being at the rate of 22.3 per cent. of all cases. At the Children's Hospital, Boston, in 1100 cases, 50 were resected, being at the rate of 4.5 per cent. This comparison seems to indicate that French conservatism is about five times as operative as is American conservatism.

Menard[1] prolably represents French opinion in general, in stating that "resection ought not to be reserved for desperate cases; if one wishes to obtain good results the operation must be done in time."

Again, Lambotte,[2] another recent French writer, says of excision, "we are of the opinion that as soon as pus exists in the capsule the best way of rapidly curing the patient is to resect without delay."

Nor can French results from operation be adjudged as altogether satisfactory, when Ollier teaches that the most desirable result after resection is complete anchylosis, and Montoz[3] would nail the femur to the acetabulum after operation to obtain this. Yet one must remember, French conservatism expects very little; for Vincent writes: "It is anchylosis in good position (without resorting to resection) that we pursue as the ideal of a cure in coxalgia."

In Germany the tide sets strongly in favor of conservatism. As Jalaguier[4] has put it somewhat graphically: "The Volkmanns, the Leisrinks, and the Koenigs, who were resection mad (*attients de résécomanie*), are now reacting, and are defending conservative operations."

Sasse[5] believes that conservative measures can be followed in 75 to 80 per cent. of all cases (leaving 20 to 25 per cent. of cases for excision), an estimate practically the same as Vincent's.

Bruns,[6] reviewing forty years' work at the Tübingen clinic, found 600 cases which he reduced to 390 cases of authenticated hip disease; and of these 69 were resected, making about 18 per cent., a proportion not far from those of the other Continental surgeons just mentioned.

Scheede, Helferich, Gussenbauer, Von Bergmann, and others at

[1] Coxalgie Tuberculeuse, Paris.
[2] Journ de Med. et de Chir. Annales, iv. 3, 261.
[3] Congrès Fr. de Chir., 1895, ix. 153.
[4] Jalaguier: Thèse d'Ag., Paris, 1886.
[5] Archiv f. klin. Chir., xxiv. 4, 719.
[6] Cent. f. Chir., 1894–96.

the German Surgical Congress in 1894, advocated conservative as contrasted with operative measures.[1]

English opinion is of two sorts: one, represented by the enthusiastic advocates of early excision, one of whom[2] would remove the head of the bone "as soon as it is suspected that caseation is advancing in it," while another asserts that "treatment short of excision, when once suppuration occurs, is useful only as a palliative or means of temporizing."[3] The other point of view, the more conservative, is represented by Mr. Watson Cheyne.[4] He would advocate excision, as follows: (1) Where the disease is progressing rapidly, where tenderness does not subside under treatment, where the fulness in the groin increases, where starting at night continues, and where the shortening rapidly extends;" (2) where primary acetabular disease is present; (3) where true dislocation has occurred.

In the United States conservative measures (for the most part in the form of ambulatory treatment by a splint affording protection and traction) are persisted in, on the whole, longer than in Europe. When conservative measures fail to give relief the propriety of excision is considered; but opinion differs widely as to the indications for its performance. Some ultra-conservatives believe that excision is practically never called for, and would treat the more advanced cases to the end by traction and fixation. In general, however, American surgical opinion favors what is known as late excision.

The practical question is this,[5] Is excision of the hip a satisfactory operation done late, when traction and fixation have failed? There is no question of the utility and generally satisfactory results of a fairly early excision of the hip, as shown by a large mass of statistics. The results may, perhaps, be inferior to a similar series of cases treated by the best conservative means, but many useful legs result, and the mortality percentage is low after the operation. The present paper is wholly directed toward the question of excision of the hip done after conservative measures faithfully tried have

[1] Loc. cit., 1894.
[2] Barker: British Medical Journal, June 9, 1888.
[3] G. A. Wright: Hip Disease in Childhood.
[4] Tuberculous Disease of Bones and Joints, 1895, p. 239.
[5] Journal of the American Medical Association, July 7, 1894.

failed—one might almost say, excision of the hip done as a last resort.

At the Children's Hospital, Boston, the attitude toward excision of the hip has remained practically unchanged for eighteen years. From 1878 to 1895 inclusive, some 1100 cases of hip disease have come to the hospital for treatment, and 50 cases have been excised. Conservative treatment at this hospital, as a rule, has consisted of protection, partial fixation, and traction to the joint. In general this is applied by means of the long traction-splint in connection with crutches and a high sole on the well foot. Activity is restricted to certain hours, but ambulatory treatment is preferred to recumbency where possible Confinement to bed is ordered for patients with sensitive joints, deformity, or abscess. Abscesses are opened as they occur. The general condition of the patient is cared for by general hygienic measures, and a convalescent house in the country is available.

The indications for abandoning conservative measures for operation, as accepted at this hospital, have been, in general, as follows:

(*a*) Persistent failure of the general health.

(*b*) A progressive destructive process in the joint, which continues in spite of favorable therapeutic conditions. This is made evident by much induration and multiple indolent sinuses through which the products of the disintegration drain rapidly away.

(*c*) The persistence of severe pain and excessive tenderness late in the disease, which are not affected by efficient traction and fixation.

(*d*) Formation of extensive sequestra in the joint.

The object of the following analysis is not primarily to investigate and tabulate the mortality (this has been done again and again in other series of cases), but incidentally to note the mortality, and really to study the condition of the cases in which this operation was done, and especially to note the character of the end-results in those cases where it can be ascertained.

The first case on the list was operated on in 1877, the last case in October, 1895. Of the whole fifty cases, only eight have been operated on since 1892, so that in the majority of all cases an interval of three or four years at least has elapsed between operation and the time of writing.

The incision in use has been generally one of the posterior ones. Traction on a bed-frame was generally used for some weeks after operation, and a protection-splint for the joint has been required for months, and oftener for years, after operation.

The group consists of fifty cases.

Mortality of the fifty cases. Nineteen are known to be dead, and three others were doing so poorly six months after operation that they undoubtedly died—a known mortality-rate of nearly 50 per cent. It is of interest in this connection that Schmidt (quoted by Laurent) found in 116 resected hips that after two and one-half years from operation only 4 per cent. died of tuberculosis; and after this period he considered them practically safe.

Of the nineteen fatal cases, four died within a week after operation, probably of shock and exhaustion; seven died in the year after operation of generalized tuberculosis for the most part; four others died from two to six years after operation; and in the other cases it is simply known that the patients died. One or two had amyloid degeneration of the viscera; one or two died from causes apparently not connected with the disease; but in most cases the cause of death was either generalization of the tuberculosis, or exhaustion, obviously due to the long drain on the system.

It does not seem likely that a closer analysis of the fatal cases would add anything to the figures on the subject or be of especial value.

The practical value of such an investigation should lie chiefly in the definition of the class of cases operated on and the character of results obtained.

The age of the patients at the time of operation was as follows:

Two years	2
Three "	1
Four "	6
Five "	4
Six "	9
Seven "	6
Eight "	6
Nine "	2
Ten "	6
Eleven "	3
Twelve "	3
Not stated	2

The duration of the disease at the time of operation, as estimated from the statements given by the parents, would be of little value and would make the time too short in most cases. The duration of several cases in the group is, however, striking:

Four had lasted	. . . . .	3 years at least.
One "	. . . . .	4 " "
Two "	. . . . .	5 " "
One "	. . . . .	6 " "
One "	. . . . .	8 " "
One "	. . . . .	9 " "

Although it is not possible to formulate it satisfactorily, it may be said that the cases ultimately coming to operation for the most part did not receive proper attention at home, and were irregular in attendance at the clinic. They were, as a rule, neglected cases. Some had never been under treatment anywhere when admitted to the wards for operation.

The symptoms most prominent in the late history of cases coming to operation were excessive pain and sensitiveness, much porky induration about the hip and profuse discharge from the sinuses.

The condition of the joint at the time of operation was of much interest, as showing how severe and extensive was the disease for which these operations were done; and a consideration of them is of special value in showing that in the more severe and extensively diseased cases a favorable outcome is not impossible.

In the fifty operations, the great trochanter was removed forty-seven times, along with the head and neck. This was necessitated by the extent of the disease. Three times only was the section made between the trochanter and head. Eight times it was noted that the shaft of the femur was more or less extensively diseased.

Where the shaft of the femur was noted as extensively diseased, the patient generally died, but one case did well where the bone was removed (in a girl of ten) two inches below the lesser trochanter.

The condition of the acetabulum was of much interest, and especially so because, so far as one may judge from these cases, perforation of the cavity was not necessarily the accompaniment of the gravest cases. The condition of the acetabulum was not noted in twelve cases; three times it was noted as normal or nearly so; twice it was noted as diseased or as containing sequestra; fifteen

times perforation had occurred. Supposing that the later condition was one of much gravity, the writer analyzed these cases as to the outcome. Of the fifteen, three are dead and one likely to die; five are in good condition, as reported below; and one was doing well one year after operation. In five the present condition is not known. This is not far from the rate of mortality in the whole group of cases.

Finally, of the fifty cases, nineteen are dead; of the remaining thirty-one, three were doing poorly when last heard from (six months after operation) and probably died. Others were heard from as doing well, as follows:

One	4	months after operation.
Five	6–8	" " "
One	9	" " "
One	10	" " "
Two	12	" " "
One	18	" " "
One	24	" " "

Nothing can be said of the present condition of these patients. They could not be traced.

The interest lies chiefly in the remainder, the cases where the present condition is known.

The detailed notes are as follows, the condition before operation being printed in small type after each case:

Case 42. The leg was amputated for osteomyelitis of the femur persisting after excision. The boy is well. The stump is healed, and he is a bicycle rider. Fourteen years since operation.

Discharge profuse. Many sinuses. Patient steadily losing.

Case 9. A bad result as to shortening, position, etc., probably due to removal from hospital against advice. Anchylosis in abduction, eversion, and flexion. Shortening of about six inches. Slight lateral curvature beginning. Eleven years since operation.

Many sinuses. Leg and thigh swollen and œdematous. Temperature 104°. Parents delayed consent to operation one month.

Case 19. Seven years and a half since operation. Sinuses healed. Motion of eighty degrees in flexion and a few degrees in abduction. Can stand on operated leg. Uses crutches still, but advised to discontinue them.

Hip and knee on same side diseased. Thickening of trochanter. No abscess. Pain persistent and uncontrollable. Operation chiefly for painful condition.

CASE 23. Six years since operation. Wears no splint, and walks on affected leg without trouble. Motion in flexion twenty-five degrees, abduction thirty degrees, rotation thirty-five degrees. Shortening of four inches.

Drunken mother and neglect at home. Abscesses and sinuses. Much thickening about joint. Flexion and abduction. Deformity of leg. Temperature 102°. General condition wretched. The operation was performed at two separate times, the patient being too weak to stand it all at once.

CASE 25. Six years since operation. Health good. No crutches for three years. Sinuses healed one year after operation. One inch shortening.

Neglect at home. Leg flexed and adducted. Much spasm and pain. No motion in joint.

CASE 26. Five and one-half years since operation. Walks well without crutches. No splint for a year. Sinuses healed for two years or more. Shortening one inch. General health good, and endurance is as good as the average.

Disease had existed nearly two years. No motion in hip. Much swelling and very painful. General condition failing.

CASE 31. Five years since operation. Shortening five and one-half inches. Motion in flexion sixty degrees, in rotation and abduction a few degrees. Can bear whole weight on operated leg. General conditions excellent. Sinuses healed.

An old, untreated case. Condition very bad. Diagnosis of rheumatism had been made some months before, outside of hospital, and no apparatus used. Thigh flexed to 100°, sinuses, and very painful.

CASE 33. Five years since operation. Shortening one and three-quarter inches. General health excellent. Walks without cane or crutch. Wearing a protection-splint. Motion in flexion forty degrees; a few degrees of motion in rotation and abduction.

Treated for once a year. Leg splint. Abscesses opened, etc. Condition gradually getting worse. Sinuses. Much swelling about hip. Tenderness and pain.

CASE 36. Four and one-half years since operation. Condition excellent. Can walk without splint or crutches. Sinuses healed.

Motion in flexion sixty-five degrees, in abduction and rotation, half of normal. Shortening one inch.

Under treatment three and one-half years. Abscesses had been opened and sinuses persisted. There was much thickening and little or no motion in joint.

FIG. 1.

Case 36.

CASE 39. Four years since operation. Can walk without splint. Shortening of two inches. Motion in flexion forty-five degrees; abduction normal. Condition good.

Much hectic. Hip very sensitive. Thigh and hip extensively swollen and indurated. Hip held in flexed position.

CASE 42. One year since operation. General condition good. Shortening about three inches. Motion of forty degrees in flexion, and a few degrees of abduction. One sinus still open. Using a traction-splint.

Flexion deformity and no motion in hip. Trochanter one and one-half inches above Nélaton's line. Old sinuses open.

CASE 43. One year since operation. General condition excellent. Shortening one inch. Sinuses open. Can bear whole weight on operated leg. Motion in flexion to sixty-five degrees; rotation normal.

Swelling so great that a large firm tumor occupied the upper thigh; dense and tender. Five sinuses reaching one-third of the way down the thigh. No motion in joint.

CASE 44. One year since operation. Sinuses healed. Shortening two and one-half inches. Condition excellent. Can stand and walk on operated leg. Motion in flexion to forty-five degrees; rotation and abduction nearly normal.

Hip flexed to right angle. Very sensitive. Much thickening about trochanter. Sinuses discharging profusely.

CASE 45. Fifteen months since operation. General condition excellent. It was so bad at the time of operation that she was too weak to sit up. Sinuses are opening. Shortening one and three-fourths inches. Motion to forty-five degrees in flexion; rotation one-half of normal.

Hip very sensitive and flexed and abducted. No motion. Temperature 102°. Not gaining in general condition.

CASE 46. One year after operation. Very sick at home. Destructive process has continued in spite of excision. Exhaustion from profuse destructive suppuration is bringing about a fatal issue.

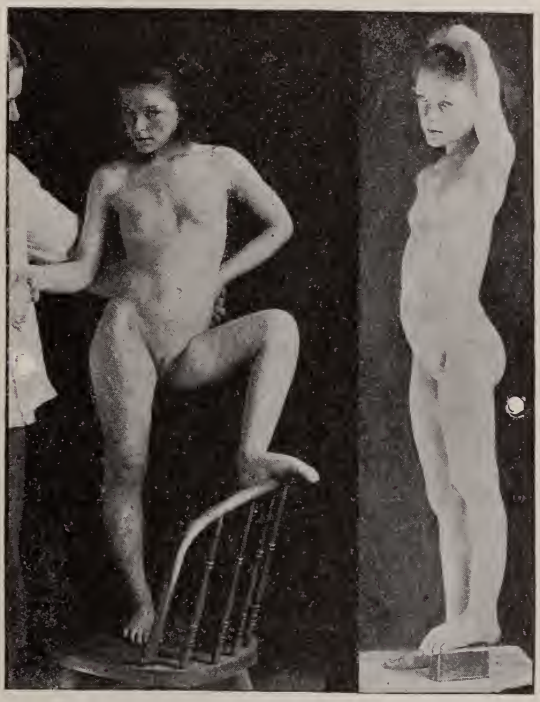
No motion. Hip very painful. Much œdema and swelling. Sinuses. Poor general condition. Consent to operation delayed by parents.

CASE 50. Acetabulum perforated. Bone removed for an inch below trochanter. Condition five years after operation: Motion apparently perfect except in abduction. No apparatus used. Sinuses healed. No pain. Patient walks without apparatus. Length of right leg, 25 inches; length of left leg, 27½ inches; circumference of right thigh, 15 inches; left thigh, 13 inches; cir-

cumference of right calf, 9¼ inches; left calf, 11¼ inches. Leg can be fully extended and flexed.

Hip very sensitive, grating on motion. Several discharging sinuses Much swelling. Failure in general condition.

FIG. 2.



Case 50.

These cases require no comment. They are all the cases which could be traced; and in many of them time enough since operation has elapsed to warrant the consideration of them as ultimate results. As an advocate of the use of fixation and traction in all cases to the latest possible moment, the writer hopes that a consideration of these cases may lead to the conclusion that late excision often produces excellent results.

The writer is indebted to his hospital associates for permission to publish their cases.

EXCISION OF THE HIP.

By WISNER R. TOWNSEND, M.D.,
NEW YORK.

To determine the exact value of any particular method of treatment in chronic disease of the hip joint is a difficult matter. Each case varies, and the statistics and the conclusions drawn from a series of cases are often misleading. I will not attempt to gather together a vast number of figures, therefore, or to quote from other authorities, but simply report the results of the operation of excision in the patients on whom it has been performed from 1886 to 1896, inclusive, in the Hospital for Ruptured and Crippled, New York. This work has been made possible for me by the kind assistance of Dr. W. J. Reynolds, late house surgeon of the hospital, who made an abstract of the histories as given in the record-books of the institution, to which has been added the final results in all cases, when these could be traced. Personally, I have had the oppotunity of witnessing all but two or three of the operations, and of making the final notes.

Following the plan of most American surgeons, the large majority of patients with hip disease at this hospital have been treated by means of the various forms of hip-splints in common use to-day. An endeavor is made to treat each case strictly on its merits, and the treatment is by no means a matter of mere routine. The patients first make application to the out-patient department, and, if the disease is just beginning, a plaster-of-Paris spica bandage is applied, which, in mild cases, is kept on until a splint is made ready, or, if the child needs hospital care, until it is admitted to the wards. If the symptoms are acute, the child is put to bed and a weight and pulley applied, with the object of overcoming the spasm and the deformity. When much deformity

exists, hip-splints are not applied until this has been overcome. The patients applying for treatment all come from the poorer walks of life, and the home-care in most cases is very inadequate. Many lack proper food, the hygienic surroundings are bad, and the necessary attention for the proper adjustment of the brace and its care are wanting, and we cannot expect as good results as when the patient can be properly cared for at all times. In many instances when first seen the disease was far advanced, and abscesses, sinuses, and marked general tuberculosis, with or without septicæmia, were present. The general vitality was low, and in some an enlarged liver and spleen indicated that amyloid changes had occurred.

From 1888 to 1896, 2295 patients with hip disease applied for treatment at the hospital, and during the same time 121 excisions were performed on 119 patients. This clearly shows what a small proportion were subjected to the operation, and explains the position that has been given to excision in the treatment of hip-joint disease in this institution. In no case was excision practised except with the view of saving life. In many instances it was a *dernier ressort;* in others it was to stop excessive drain from prolonged suppuration, to check amyloid changes, or to clean out and drain septic abscesses. Excision was never practised in the first stage of the disease, save in one case of double hip disease, and all but six cases were complicated by an abscess or sinus. The operation was resorted to only when other methods of treatment had apparently failed, and when it was believed that if some operation were not performed death inevitably would soon result. In some patients the previous treatment had been careful, thorough, and scientific, but the progress of the disease was not checked, and excision was resorted to, while in others neglect and poor treatment rendered the operation necessary. From the fact previously mentioned, that these patients in many instances did not have proper home-care, no inference can be drawn as to the value of the different forms of splints used during the previous treatment, or as to the value of aspiration of abscesses or injection of iodoform and oil as tending to render an excision necessary. In fact, quite a number of the patients were transferred from the out-patient department to the hospital wards because their parents systematically

neglected them, and much of the benefit from the brace treatment was entirely lost, and no doubt in some positive harm was done.

In considering the ages of the patients it must be stated that the hospital treats in the in-patient department only those children who are between the ages of four and fourteen, and a very few cases over the hospital age-limit were referred to other institutions for operation. The total number of patients operated upon, including those referred to other institutions, does not exceed 5 per cent. of the total number of cases seen, and this represents the most severe examples.

Abscesses or sinuses, much more often septic than non-septic, were present in 113 patients out of 119, and this emphasizes the importance of proper treatment of this complication. This subject has been thoroughly discussed of late years, and the fact clearly established that a cold abscess should be opened, thoroughly curetted, and properly drained whenever it becomes septic. Had this been done in every instance, the number of excisions would have been smaller. In the large majority the patients were suffering from sepsis before the operation was performed, and naturally this also affected the ultimate result.

From a study of these cases the conclusion is inevitable that in a great many the fatal result was due more to sepsis than to tuberculosis. In many cases the osteomyelitis present and the deep burrowing of the abscesses rendered perfect drainage almost impossible either before or after the operation. The number of cases of hip-disease where abscesses were present but not infected, or when infected were promptly opened and properly drained, proved also that sepsis is responsible for the result. Much more than 5 per cent. of all patients with hip disease develop abscesses, and yet make a good recovery and never suffer from general sepsis.

In 10 per cent. of the cases there was marked osteomyelitis present, and in these the difficulty of perfect drainage is always great. In several instances counter openings were made lower down in the shaft of the bone and gauze drains passed into the medullary canal; but when this complication exists, and the patient has in addition much bony destruction of the joints from tuberculosis, I believe amputation at the hip-joint will give better results than excision; certainly the results in the cases the writer has had

the opportunity to observe have been anything but encouraging. The shock accompanying an amputation will undoubtedly be greater than that resulting from an excision, but the cause of the sepsis will at once be done away with, and if the shock is not too serious there will be a better chance for the patient's recovery.

The duration of the hip disease at the time of the operation in about 70 per cent. of the cases was from one to three years, and as the patients were all in the third stage of the disease the figures are such as we would expect. Careful inquiry was made in every instance to determine if possible the cause of the disease, and in 6 per cent. it was ascribed to a fall, a very small percentage, if we are to believe some authorities. In two instances children were subjected to osteotomy for the relief of the flexion deformity after hip-joint disease, and sepsis occurred and excision was subsequently done.

The acetabulum was involved in about 10 per cent. of the cases, and it was usually impossible to determine before the operation whether or not this bone was diseased. In but one case was there found complete bony anchylosis of the femur to the pelvis. In one case the head of the femur was found loose as a sequestrum in the joint, and in several others, portions of loose bone were present, but in the majority more or less complete destruction of the head of the femur had taken place. Two children were subjected to excision of both hips, in one case both operations being performed at one sitting, and in the other after an interval of about a year. Both subsequently died.

The total number of operations was 121, the total number of patients, as has been said, being 119, 78 were males, and 41 females. The right hip was removed in 69 operations, the left in 52. In 24 the anterior incision was made use of, and in 97 the posterior. In cases of the kind here reported no typical operation can be performed. The incision is made so as to open the abscess or follow up a sinus, but our preference is for the posterior incision. The operations were performed under ether anæsthesia, except in three cases, when nitrous oxide gas was used. The plan was always to operate rapidly, remove the diseased tissues as thoroughly as possible, and to stop all hemorrhage promptly either by ligature or pressure. The wound was thoroughly packed with

iodoform-gauze, and in the earlier cases a plaster-of-Paris spica bandage was applied to keep the limb in proper position. The latter procedure has not been carried out for the last four years, as it was feared that the wet plaster enveloping the child might have been responsible for some of the deaths from shock, and it also delayed getting the patient back to bed, as it was necessary for the plaster to set before removing the child from the operating-table. A long side splint is now used instead of the plaster, and a weight and pulley are applied to the limb to make proper traction. These can be applied after the child has been returned to bed.

The subsequent care of the wound consists in dressing it every second or third day, in order to secure proper drainage and to prevent absorption of pus, if it is septic, and to promote healing by granulation from the bottom. The attempts to sew up the wound in these cases have proved failures, and no matter how carefully the operation is performed it is almost impossible to obtain primary union when marked sepsis is present. The incision wounds are sometimes very slow in closing, and sinuses may persist even for years. The average time for the closing of the wound in the cases that have done well has not been less than six months. Various solutions have been used to encourage healing, but washing with peroxide of hydrogen and the application of balsam of Peru and olive oil have given the best results. Occasionally sinuses have been curetted and stimulating applications have been made to them.

Of the 121 excisions it has been possible to trace but 101. Of the ninety-nine patients traced, fifty-two are known to be dead; and these include the two cases in which both hips were removed. Of these fifty-two deaths, fifty-one were attributable to the diseased condition present and one to accidental drowning. In the latter case the hip had recovered and was in good condition at the time of death. The cause of death in twenty-eight was exhaustion; in nine, shock; and in nine tuberculous meningitis. The other causes were uræmia, œdema of the lungs, tuberculous peritonitis, one each, and heart-failure two. Exhaustion was responsible for over 50 per cent. of the fatalities, and this includes all cases of amyloid degeneration, besides those cases in which general tuberculosis developed. Long-continued suppuration and the weakening effects of sepsis helped to make this the most frequent

cause. Of the cases of meningitis, in only one instance could the operation be held responsible for its development. In this patient the symptoms appeared twelve days after the excision, while in the others the period was much later, and the operation probably neither delayed nor hastened the fatal termination. These figures show that meningitis was the cause of death in 10 per cent. of the cases traced.

Of the fatal results, thirty-seven occurred within six months after the operation and ten more within one year. In nine cases of shock death occurred within forty-eight hours. That more patients did not die from shock is due, I believe, to the rapidity of operating, to the small amount of anæsthetic used, and to the subsequent faithful and efficient care of the house staff and nurses. The mortality-rate in this series of cases is thus seen to be about 52 per cent., and when the condition of many of those operated upon is considered it is evident that no other result could be expected.

The only question to be decided is: Should we perform an excision in such cases, or should we amputate at the hip-joint, or refuse to operate? As previously stated in this paper, my preference in the future would be for amputation in the extreme cases and an earlier operation in those presenting abscesses and constitutional symptoms. We should do everything possible to avoid the occurrence of sepsis, but if it is present we should operate promptly and in a thorough manner. With efficient treatment by the hip-splint, combined with bed care, and, when necessary, weight and pulley, but few cases will require excision. If an abscess is present and giving rise to symptoms, no harm can result from a thorough operation and the exploration of the joint. If the latter is diseased, the head of the femur should be removed; if it is not, no excision is necessary.

Of the patients traced, forty-seven are living; and of this number twenty-six are cured of the disease with varying amounts of shortening and with varying degrees of deformity. The latter in most cases is slight. The shortening depends upon the amount of bone originally removed and upon the time that has elapsed since the operation. The fact that the upper epiphysis of the femur is removed, and that its presence is responsible for part of the growth

of the limb, easily accounts for the fact that in three cases seen six years after operation the average shortening was 3.16 inches. In four patients seen five years after operation it was 2.68 inches, while in those observed during two years or less it was one inch. The shortening is not of great consequence, provided the limb is straight and in good position. When much flexion-deformity is present we usually also find more or less adduction, and this is a serious matter. In ten patients the limb was extended to 180°; in six, to 170° or over; in seven, to 165°, and in six, to 160°. These twenty-nine may be said to have the limb in a position that makes locomotion easy, and are cured without flexion-deformity. All beyond this have flexion and some lordosis as a result. The amount of motion in the joint varies; in one it is 130°; in three the limb can be brought to a right angle (90° of motion); six have from 30° to 40°; eight have from 5° to 30°, and in twenty-six there is no motion. It was not possible to measure the degree of motion or the angle of greatest extension in every case; hence these data are missing in a few cases.

Of the forty-seven patients known to be living, we have found twenty-six cured. Of the remaining twenty-one, fully one-half are in bad condition, and will die from exhaustion if not from other causes, as the result of long-continued suppuration. Of this number, in two the sinuses are still discharging, six years after the operation; in one, after five years; in two, after four years; in one, after three years; and in two, after two years. In the remaining cases too little time has elapsed since the excision was done to allow of a final report being made. The results may be stated as twenty-six cures after 101 operations, and we have reason to believe that of the patients not traced many are living. To save only one patient out of every four operated upon, while not brilliant, shows that some good has been done, for these were all desperate cases, and we believe the patients would have died had the operation not been performed.

Whether amputation will save more lives in the same number of cases remains to be seen. Excision, to prove of benefit in a large percentage of cases, must be done early, and then the question is, Are we justified in operating early, knowing the good results to be obtained from mechanical treatment? The majority will answer

in the negative, or in favor of the treatment by means of the various hip-splints now in use; and as our knowledge in their application increases and the general practitioner learns to interpret the early symptoms more promptly, so will the necessity for excision diminish.

RESULTS IN 121 EXCISIONS OF THE HIP PERFORMED ON 119 PATIENTS AT THE HOSPITAL FOR RUPTURED AND CRIPPLED, NEW YORK, 1888 TO 1896 INCLUSIVE.

Dr. V. P. Gibney	performed	100
Dr. W. R. Townsend	"	15
Dr. W. J. Reynolds	"	3
Dr. Royal Whitman	"	1
Dr. W. B. Thompson	"	1
Dr. W. R. Martin	"	1

A summary of the cases here reported is as follows:

Total number of patients operated upon		119
" " of excisions of the hip-joint		121
Males	78	
Females	41	
Right hip	69	
Left hip	52	
Due to a fall	20	
Cause unknown	101	
Anterior incision	24	
Posterior "	97	
Age at time of operation, 3 years	1	
" " " 4 "	12	
" " " 5 "	13	
" " " 6 "	17	
" " " 7 "	15	
" " " 8 "	16	
" " " 9 "	14	
" " " 10 "	13	
" " " 11 "	8	
" " " 12 "	6	
" " " 13 "	2	
" " " 14 "	3	
" " " 15 "	1	
Acetabulum involved in	18	
Of this number there are living	10	
" " " " dead	6	
Cannot be traced	2	
Marked osteomyelitis present	10	
Duration of disease before operation, 2 weeks	1	
" " " " " 3 months	1	
" " " " " 6 months	2	
" " " " " 8 months	3	
" " " " " 1 year	41	
" " " " " 2 years	37	
" " " " " 3 "	13	
" " " " " 4 "	6	
" " " " " 5 "	5	

Duration of disease before operation, 6 weeks	2
" " " " " 7 "	3
Time unknown	7
Abscesses or sinuses were present	113
No abscesses	8
Double hip disease	3
Both hips were excised	2
Hip and spinal disease present	5
Hip and knee disease	2
Hip and tarsal disease	2
Hip, pubes, and ilium involved	1
Hips and pubes	1
Hip, sacrum, and coccyx	1
Disease developed after Gant's operation of osteotomy	2
Head of femur loose in acetabulum	1
Syphilis present	1
Cases operated upon in 1888	3
" " " " 1889	1
" " " " 1890	6
" " " " 1891 (3 cured)	22
" " " " 1892 (4 ")	16
" " " " 1893 (3 ")	13
" " " " 1894 (0 ")	15
" " " " 1895 (7 ")	17
" " " " 1896 (9 ")	28
Shortening noted 6 years after operation, 4 inches in	1
" " " " " 3 "	1
" " " " " 2½ "	1
Average . . . 3.16 inches.	
Shortening noted 5 years after operation, 4 inches in	1
" " " " " 3 "	
" " " " " 2½ "	1
" " " " " 1¼ "	1
Average . . . 2.68 inches.	
Shortening noted 4 years after operation, 2¾ inches in	1
" " " " " 2½ "	1
" " " " " 1½ "	2
" " " " " 1¼ "	1
Average . . . 1.6 inches.	
Shortening noted 3 years after operation, 1½ inches in	1
" " " " " 1 "	1
" " " " " ¾ "	2
Average . . . 1.08 inches.	
Sinuses exist after operation for 6 years in	2
" " " " " 5 "	1
" " " " " 4 "	2
" " " " " 3 "	1
" " " " " 2 "	2
" " " " " 1 "	12
Deaths 52. From exhaustion 28. Shock 9.	
Tuberculous meningitis	9
Developed 12 days after operation in	1
" 1½ months after operation in	1
" 2 " " "	2
" 2½ " " "	1
" 3 " " "	1

Developed 5 months after operation	2
" 14 " " "	2
From acute uræmia	1
Œdema of lungs	1
Tuberculous peritonitis, developed 4 months after operation	1
Heart-failure	2
Drowning, nearly two years after operation	1
Death occurred within 6 months of operation in	37
" " " 1 year " "	10
" " " 2 years " "	3
" " " 5 " " "	2

TABLE SHOWING SHORTENING, MOTION, NUMBER OF SINUSES PRESENT, AND ANGLE OF GREATEST EXTENSION IN 47 CASES OF EXCISION.

No.	Abstract number.	Date of operation.	Time since operation.	General condition to-day.	Sinuses present.	A. G. E.	Motion in degrees.	Shortening in inches.
1	7	June 13, 1890	6¾ years.	Good	3	150	0	2½
2	8	Dec. 5, "	6¼ "	Fair	1	135	0	4
3	13	Feb. 10, 1891	6 "	Good	0	180	100	3
4	17	Apr. 24, "	5¾ "	"	0	180	35	3
5	19	June 2, "	5¾ "	Fair	0	145	10	4
6	23	Sept. 8, "	5½ "	Good	1	165	0	1¼
7	33	Apr. 18, 1892	5 "	"	0	155	5	2½
8	37	July 1, "	4¾ "	"	3	160	0	2½
9	41	Oct. 7, "	4½ "	"	0	160	0	2¾
10	44	Dec. 9, "	4¼ "	"	0	165	0	1¼
11	50	Jan. 21, 1893	4 "	"	0	150	0	1½
12	51	Feb. 24, "	4 "	Poor	4	....	0	1½
13	59	Oct. 31, "	3½ "	Good	0	155	0	1½
14	60	Nov. 10. "	3½ "	"	0	160	30	1
15	66	Feb. 2, 1894	3 "	Poor	1	165	0	¾
16	77	Mar. 19, 1895	2 "	Fair	2	145	30	¾
17	78	" 19, "	2 "	Good				
18	79	Apr. 9, "	2 "	Fair	1	170	0	½
19	82	" 23, "	2 "	Good	0	150	0	3
20	84	May 7, "	1¾ "	"	0	175	...	½
21	85	" 7, "	1¾ "	"	0	165	30	½
22	88	July 2, "	1½ "	"	0	150	0	1
23	90	" 30, "	1½ "	"	0	150	0	1½
24	91	Oct. 15, "	1¼ "	"	1	180	0	½
25	93	" 29, "	1¼ "	Fair	6	175	15	1
26	94	Jan. 7, 1896	1 "	Poor	2	165	0	2½
27	96	Feb, 4, "	1 "	Good	0	170	0	1½
28	99	Mar. 10, "	1 "	"	0	155	0	1
29	100	" 24, "	1 "	"	0	175	0	½
30	101	" 31, "	1 "	Poor	0	180	10	1¼
31	103	Apr. 28, "	11 months	"	3	170	0	¼
32	104	May 12, "	10 "	"	0	180	40	1¼
33	105	" 19, "	10 "	Good	3	165	0	½
34	106	" 26, "	10 "	"	0	160	0	½
35	107	June 2, "	10 "	"	1	165	0	1
36	108	" 9, "	10 "	Poor	1	160	0	¼
37	109	" 9, "	10 "	Good	3	155	10	1¼
38	110	" 23, "	9 "	"	1	....	0	½
39	111	" 27, "	9 "	"	0	....	...	½
40	113	July 3, "	9 "	Poor	1	170	0	½
41	114	" 8, "	9 "	Fair	3	....	...	1
42	116	" 24, "	8 "	Good	0	180	130	½
43	117	" 24, "	8 "	"	0	180	...	¼
44	118	" 28, "	8 "	Poor	1	165	10	¾
45	119	Aug 14, "	7 "	"				
46	120	" 25, "	7 "	Good	0	180	10	1¼
47	121	Sept. 1, "	7 "	"	0	160	70	¼

In these abstracts the data are given under the following headings:

Sex. Hip involved.
Age at time of operation.
Date of operation.
Duration of disease.
Cause.
Condition at time of operation.
Previous treatment.
Operation.
Anæsthetic used.
Subsequent treatment.
Result.

CASE I.—Male; right hip; five years; July 17, 1888; one year; a fall; general condition poor, two discharging sinuses; no local treatment; posterior incision; ether; plaster-of-Paris spica; was known to be alive three years after the operation. Can find no trace of him since then.

CASE II.—Female; right hip; eleven and one-half years; November 23, 1888; two years; no known cause; general condition poor, one discharging sinus; hip-splint; posterior incision; ether; plaster-of-Paris spica; November 23, 1888, died of shock.

CASE III.—Male; left hip; seven years; December 14, 1888; one year; cause unknown; general condition poor, large abscess over anterior portion of thigh; liniments; posterior incision; ether; plaster-of-Paris spica; April 15, 1889, died of exhaustion.

CASE IV.—Female; left hip; six years; April 12, 1889; two years; unknown; general condition poor, one freely discharging sinus over the joint; no local treatment; posterior incision; ether; general stimulation; April 12, 1889, died twelve hours after operation from shock.

CASE V.—Male; right hip; eleven years; March 14, 1890; four years; fell downstairs, pain and lameness immediately following; general condition poor, a large abscess over the right trochanter, hip held firmly at 140°; muslin spica and tonics from December 27, 1886, to February 26, 1890, when a Taylor brace was applied and high shoe for opposite foot; posterior incision, closed with catgut, small drainage-tube; ether; Taylor brace; wound did not heal by first intention, but by October 4th had entirely closed. January 11, 1891, general health good, A. G. E.

180°. Thirty degrees of motion. Two inches shortening; was walking with a caliper brace. During the summer of 1891 boy was accidentally drowned.

CASE VI.—Male; left hip; four and one-half years; May 6, 1890; one year; fall from a lounge, symptoms followed immediately; general condition fair; hip-splint; posterior incision; ether; October 4, 1894, general condition good; has worn no brace for two years; one-half inch shortening; A. G. E. 160°; 15° of motion; February 1, 1897, cannot trace.

CASE VII.—Male; right hip; seven years; June 13, 1890; one year; unknown; general condition fair, immense abscess over nates; no history; posterior incision, closed with catgut, counter opening for drainage; ether; hip-splint; wound did not heal by first intention, and one year later there were three sinuses. November 7, 1890, an abscess was opened above Poupart's ligament, which probably burrowed through the acetabulum. March 23, 1897, general condition good, three sinuses, discharge slight; A. G. E. 150°; two and one-half inches shortening; no motion.

CASE VIII.—Male; left hip; ten years; December 5, 1890; one and one half years; unknown; general condition poor, marked adduction of the thigh, no motion at the hip, abscess on outer part of thigh; Thomas hip-splint and high shoe on well foot; posterior incision, acetabulum and upper head of femur much diseased; ether; hip-splint, Judson perineal crutch; wound suppurated very freely. May 26, 1894, parts entirely healed with the exception of a small sinus in the incision wound. February 26, 1897, general condition fair, wearing a hip-splint, cannot walk without it. Four inches shortening; no motion in joint. A. G. E. 135°; leg rotated out and slight knock-knee. One discharging sinus. Hip tender, painful, and indurated.

CASE IX.—Male; right hip; five and one-half years; December 9, 1890; mother states disease began when child was three months old; unknown; general condition poor, three discharging sinuses, hip held at 150°, child in a double plaster-of-Paris spica, as the opposite knee is also involved; hip-splint and plaster-of-Paris spica; posterior incision; ether; plaster-of-Paris spica; wound suppurated. February 14, 1891, two sinuses discharging. March 15th developed tuberculous meningitis. Died March 24th.

CASE X.—Male; right hip; ten years; December 19, 1890;

two and one-half years; no known cause; general condition very bad, has ten sinuses about the joint, no motion in the hip, albumin in urine, hyaline and granular casts, liver enlarged; hip-splint, rest in bed, opening of abscesses as they appeared; posterior incision, osteomyelitis of femur present, portion of the shaft removed, acetabulum and sinuses curetted; ether; rest in bed, tonics, stimulants; November 6, 1891, died of exhaustion.

Case XI.—Female; right hip; nine years; January 23, 1890; two years; unknown; general condition poor, two sinuses over the hip, 20° of motion; first seven months, weight and pulley in bed, later hip-splint; posterior incision; ether; plaster-of-Paris spica; March 19th, discharge from the incision wound is free and comes through three sinuses, much infiltration about the joint, general condition of child very poor. She is removed from the hospital. August 21, 1891, died of exhaustion.

Case XII.—Male, left hip; six and one-half years; January 27, 1891; general condition poor; posterior incision, head of femur adherent to acetabulum, osteomyelitis present; ether; February 1, 1897, cannot trace.

Case XIII.—Male, right hip; ten years; February 10, 1891; two years; a fall; general condition very poor, has been running a high temperature for six months, large abscess over the joint, has had double hip disease for the past year, left hip painful, tender, but in good position, kept so by a double plaster-of-Paris spica; hip-splint, rest in bed, plaster-of-Paris spica; posterior incision, head and neck of the femur removed, acetabulum perforated, osteomyelitis of the femur, medullary canal thoroughly curetted, wound not closed, gauze drain left in; ether; Thomas hip-splint and high shoe; September 16, 1891, wound was entirely healed. January 1, 1897, his general health is perfect, right hip almost perfect, walks very well, and only has pain after extreme exertion. Right hip, three inches shortening. Motions good in every direction, but extreme flexion causes pain. A. G. E., 180°; A. G. F., 80°. Wears a high shoe on the right foot. This case of double hip disease was extremely interesting from the fact that the disease was so much more severe on one side than on the other, and that, despite the long-continued suppuration, the boy recovered.

Case XIV.—Male, left hip; eleven years; February 13, 1891;

two years; unknown; general condition fair, one discharging sinus; has had disease of the right hip for about ten days; hip-splint, aspiration of abscess; posterior incision, acetabulum diseased; ether; hip-splint, plaster-of-Paris spica; died December 25, 1891, of exhaustion following general tuberculosis. Note: Same patient as Case XLV.

Case XV.—Female, right hip; ten years; February 20, 1891; two years; symptoms began five months after a fall; general condition poor, hip very tender, freely discharging sinus in Scarpa's space, large abscess in gluteal region; hip-splint (Taylor); posterior incision, made to connect with fistulous opening in the middle and upper third of thigh, wound packed with gauze; ether; patient kept in bed; as discharge was very free, parts were washed out daily and several new abscesses that appeared were opened; July 2, 1891, died from exhaustion.

Case XVI.—Male, right hip; five years; February 27, 1891; two years; a fall on the sidewalk; general condition very bad, pulse weak, much discharge from an abscess in the gluteal region; plaster-of-Paris spica from January 6th to date of operation, prior to that no treatment. January 19th a large abscess opened and one quart of pus evacuated. Patient collapsed and did not rally for several hours; posterior incision, head and neck removed, very little hemorrhage, shock extreme; ether; stimulants, rest in bed; February 27th patient died shortly after operation from shock.

Case XVII.—Female, right hip; ten years; April 24, 1891; two and one-half years; no known cause; general condition poor, three discharging sinuses; hip-splint, abscesses opened as they occurred; head of femur found loose in acetabulum, most of joint capsule destroyed, portion of upper end of shaft of femur removed, wound packed with gauze; ether; hip-splint; December 28, 1896, general condition good, walks without pain, but tires easily, limps very badly, three inches shortening, A. G. F. 45°, A. G. E. 180°. Says the sinuses had all healed by end of 1892.

Case XVIII.—Male, right hip; eight and one-half years; April 28, 1891; time unknown; no known cause; general condition poor, four discharging sinuses; hip-splint, abscesses opened; posterior incision; ether; free drainage, Thomas hip-splint; August 1, 1892, died from exhaustion.

CASE XIX.—Male, right hip; eleven and one-half years; June 2, 1891; over two years; cause unknown; general condition poor; hip-splint; anterior incision; hip-splint; July, 1896, general condition fair, marked limp, leg much atrophied but straight, 10° of motion, A. G. E. 145°; four inches shortening, walks without a brace for long distances without pain.

CASE XX.—Male, right hip; six years; July 14, 1891; two years; developed six months after a fall downstairs; general condition fair, large abscess over the trochanter, marked infiltration and spasm, hip held at 100°; no treatment; posterior incision, wound partly sewed up with catgut; ether; hip-splint; wound had entirely closed November 14, 1891, and on March 30, 1892, discharged from the hospital, wearing one-inch high shoe and caliper hip-splint; A. G. E. 165°; two inches shortening; February 1, 1897, cannot trace.

CASE XXI.—Female, left hip; nine years; July 14, 1891; three and one-half years, and Pott's disease in lower dorsal for one year; unknown; general condition poor; no previous treatment; posterior incision, acetabulum found diseased and curretted; ether; plaster-of-Paris spica; March 30, 1892, died of tuberculous meningitis.

CASE XXII.—Male, right hip; eight years; July 30, 1891; two years; no known cause; general condition poor, leg everted, marked spasm, marked infiltration, large abscess over the outer portion of thigh; plaster-of-Paris spica and hip-splint; posterior incision, head partly destroyed by the disease, marked erosion of acetabulum. In endeavoring to dislocate the femur it was fractured three inches below the hip-joint, although very little force was used. Wound packed with gauze; ether; hip-splint and rest in bed; December 23, 1891, wound had entirely closed with the exception of two small sinuses. December 26th developed tuberculous meningitis. January 1, 1892, died.

CASE XXIII.—Male, right hip; ten years; September 8, 1891; two years; fall against an iron railing; general condition very poor, profuse discharge from three sinuses about the joint, has a high temperature every evening, no albumin in urine; hip-splint, plaster-of-Paris spica and abscess aspirated; posterior incision, wound packed with gauze; ether; plaster-of-Paris spica and hip-splint;

February 1, 1897, has worn no apparatus for four years, has one discharging sinus, general condition is excellent, there is no motion at the hip, A. G. E. is 165°, one and one-quarter inch.

Case XXIV.—Male, left hip; five years; September 27, 1891; one year; no known cause; general condition very bad, has large discharging sinus on outer side of thigh, high temperature, rapid pulse, parts about the joint glazed in appearance; Sayre hip-splint; posterior incision, head of bone found entirely eroded, marked osteomyelitis of the femur, medullary canal thoroughly curetted; ether; stimulants and rest in bed; child died six hours after operation from shock.

Case XXV.—Male, left hip; twelve years; October 2, 1891; eight months; unknown; general condition poor, large abscess involving all of gluteal region, large abscess on inner side of thigh, two sinuses on middle of thigh, A. G. E. 110°; no previous treatment; posterior incision; ether; hip-splint; June 29, 1892, five small sinuses, slight amount of discharge, A. G. E. 170°, 40° of motion; much induration of the soft parts of upper portion of thigh, two inches shortening. February 27, 1897, cannot trace.

Case XXVI.—Male, left hip; eight years; October 2, 1891; three years; no known cause; general condition poor, had Pott's disease of the first five dorsal vertebræ for the last five months, and has been in bed on a frame with weights and pulleys. Has three discharging sinuses about the hip-joint, very little motion; hip-splint for two and a half years, a frame for six months; posterior incision, marked osteomyelitis of the shaft of the femur; ether; plaster-of-Paris spica until February, 1892, then a long Thomas hip-splint and crutches. In March, 1893, a Knight spinal brace and Taylor hip-splint; in August, 1893, the sinuses had entirely healed, patient left off all apparatus and felt very well, two inches shortening of the leg. June, 1896, died of dropsy; hip said to be in good position.

Case XXVII.—Male, left hip; seven and one-half years; October 13, 1891; one and one-half years; no known cause; general condition poor, two large discharging sinuses, hip painful and tender, marked infiltration about the joint; hip-splint, aspiration of abscess; posterior incision; ether; hip-splint; June 29, 1892, general condition good, one inch shortening, A. G. E. 170°, A. G. F.

90°, no pain, one small discharging sinus. February 1, 1897, boy moved to the country, and it has been impossible to trace him.

CASE XXVIII.—Male, left hip; eight and one-half years; October 20, 1891; three and one-half years; no known cause; general condition poor, large abscess over the outer side of the thigh, much tenderness on upper side of thigh, an open sinus, moderate discharge. Near this sinus are three cicatrices. Hip painful, much adducted. Liver enlarged, extends one and one-half inches below the free border of the ribs; brace and aspiration of abscesses; posterior incision, wound packed with gauze; ether; plaster-of-Paris spica, rest in bed. December 11, 1891, died from exhaustion.

CASE XXIX.—Male, left hip; six and one-half years; November 20, 1891; duration and cause unknown; general condition poor, two discharging sinuses over joint; hip-splint for six months and aspiration of the abscesses; posterior incision, head and neck removed, packed with gauze; ether; plaster-of-Paris spica and wound dressed daily. August 20, 1892, three discharging sinuses, a hip-splint applied and patient allowed to get up; September 21, 1892, leg badly adducted, two inches shortening, very little motion in the hip, much pain, liver much enlarged, albumen in the urine. Was removed from the hospital and death occurred a short time later.

CASE XXX.—Male, left hip; nine years; November 24, 1891; two years; unknown; general condition poor, six discharging sinuses about the joint; no treatment; posterior incision; ether; plaster-of-Paris spica; June 3, 1892, discharged from hospital. Died one week later of exhaustion.

CASE XXXI.—Female, right hip; six years; December 1, 1891; two years; a fall; general condition poor; plaster-of-Paris spica; posterior incision; ether; plaster-of-Paris spica, double Thomas hip-splint; October 19, 1893, removed from hospital. General condition very poor. Died shortly afterward of dropsy; this case was of interest from the fact that both hips were excised at the same time, and that several months later she nearly bled to death from a drainage-tube pressing on the femoral artery and causing a slough from pressure. Same patient as Case XXXII.

CASE XXXII.—Female, left hip; six years; December 1, 1891; two years; a fall; general condition poor, discharging sinus in Scarpa's space; plaster-of-Paris spica; posterior incision; ether;

plaster-of-Paris spica, double Thomas hip-splint; October 19, 1893, removed from hospital, died shortly afterward of dropsy. Same patient as Case XXXI.

Case XXXIII.—Female, left hip; seven years; April 8, 1892; one year; fall from a sled; general condition fair, inguinal and femoral adenitis, large abscess over joint; frame, aspiration of abscess; posterior incision, head of bone completely destroyed, acetabulum eroded; ether; hip-splint; June 14, 1895, wearing hip-splint and high shoe, two and one-half inches shortening, A. G. E. 155°, 5° of motion. February 1, 1897, general condition very good. Reports she can walk long distances without fatigue. Lives out of town.

Case XXXIV.—Female, right hip; twelve years; May 10, 1892; two years; no known cause; general condition poor, two discharging sinuses; hip-splint, aspiration, and later free opening of abscesses; posterior incision, wound packed with gauze; ether; plaster-of-Paris spica, hip-splint, frequent curetting of sinuses; August 23, 1895, general condition good, was reported as being strong and well, no discharging sinuses, wearing no brace, two and one-half inches shortening. Died suddenly of heart-failure.

Case XXXV.—Male, right hip; eight years; May 17, 1892; two years; no known cause; general condition fair, large abscess over the hip; hip-splint, Taylor adduction brace; unsuccessful effort at aspiration; posterior incision, packed with gauze; ether; hip-splint, open incision of two abscesses which appeared one year after the operation; September 6, 1895, no discharging sinuses, wearing no apparatus, walking well with the aid of a one-inch cork sole on left shoe. July, 1896, three and one-half inches shortening, slight adduction, walks well, general condition excellent. February 1, 1897, cannot trace.

Case XXXVI.—Male, right hip; four years; June 10, 1892; one and one-half years; unknown; general condition poor, three discharging sinuses, discharge very profuse and foul smelling; hip-splint, free incision and drainage of abscesses; posterior incision; ether; stimulants, rest in bed; died twelve hours after operation from shock.

Case XXXVII.—Male, right hip; nine years; July 1, 1892; six months; no known cause; general condition poor, two dis-

charging sinuses over the joint; free opening of abscesses, thorough drainage, plaster-of-Paris spica; posterior incision, packed with gauze; ether; hip-splint, frequent curetting of sinuses; July 31, 1895, had nine discharging sinuses, liver much enlarged, extends down to the pelvis, albumin in urine. March 15, 1897, walking without apparatus, marked limp, uses crutches, three discharging sinuses, very little diminution in size of liver, general condition good, A. G. E. 160°, no motion, two and one-half inches shortening. The discharge from the sinuses in this case, both before and after operation, was enormous, very fetid, and the question of amputation at the hip-joint was discussed, but at no time was the boy's condition thought to warrant it.

Case XXXVIII.—Male, left hip; seven years; September 6, 1892; four years; no known cause; general condition poor, small abscess over anterior and external portion of thigh; hip-splint, weight and pulley, in bed, plaster-of-Paris spica; posterior incision, wound closed with catgut, counter opening and drainage-tube inserted; ether; wound did not heal, extensive suppuration, plaster-of-Paris spica, curetting of sinuses; January 15, 1893, developed tuberculous peritonitis. January 24th, died.

Case XXXIX.—Male, right hip; eleven years; September 27, 1892; six years; unknown; general condition poor, two discharging sinuses; was first treated in 1886 by rest in bed, crutches when up, and tonics. Made a good recovery. No signs of abscesses, and could go about with comfort. Was readmitted August 11, 1892, kept in bed with weight and pulley until date of operation; posterior incision, marked osteomyelitis of femur; ether; kept in bed. January 26, 1893, on account of extreme amount of discharge, a second operation was done and several inches of shaft of femur removed, marked general œdema present at time of operation. February 22, 1893, died suddenly.

Case XL.—Male, left hip; six years; September 30, 1892; thirteen months; a kick in the left groin(?); general condition good, one discharging sinus over joint, has tarsal disease; hip-splint, curetting of diseased tarsal bones; posterior incision; ether; hip-splint; September 13, 1893, general condition good, no shortening, very little motion, one discharging sinus. February 1, 1897, cannot trace.

CASE XLI.—Female, right hip; nine years; October 7, 1892; two years; no known cause; general condition poor, one discharging sinus; no treatment for one and one-half years, six months prior to operation hip-splint, evacuation of abscess by aspiration, injection of iodoform and oil; posterior incision, wound closed with catgut, counter opening and drainage-tube inserted; ether; posterior Thomas splint, opening of two abscesses that appeared four months after operation; April 31, 1893, had severe attack of pneumonia. May 31, 1894, A. G. E. is 135°, and there are nine discharging sinuses. September 7th, six sinuses. December 6th, one sinus and thirteen cicatrices. The sinuses were treated by injections of creosote. January 3, 1895, all sinuses healed, brace left off, and wears high shoe. February 1, 1897, general condition good, hip held firmly locked at 160°, two and three-quarter inches shortening, walks well, no motion.

CASE XLII.—Male, right hip; eight and one-half years; October 14, 1892; six months; no known cause; general condition poor, one discharging sinus; hip-splint, weight and pulley in bed, plaster-of-Paris spica, abscess evacuated and iodoform and oil injected; posterior incision, head and neck removed, marked osteomyelitis, interior of medullary canal thoroughly curetted for several inches below point of removal of head and neck, packed with gauze; ether; until January 1, 1893, wound dressed three times a week, discharge slight, was healing nicely; January 1, 1893, developed meningitis. Died January 7, 1893. Post-mortem, heart normal. Area of consolidation at base of each lung. Liver enlarged. Pus and tubercles between pia and dura mater in the posterior fossa, base of skull.

CASE XLIII.—Female, left hip; fourteen and one-half years; November 29, 1892; two years; unknown; general condition poor, one discharging sinus; hip-splint, aspiration of abscesses and injection of iodoform and oil; posterior incision, part of shaft removed, as it was found diseased; ether; hip-splint; discharged from hospital April 20, 1893, had several discharging sinuses, general condition very poor. Died soon after leaving hospital.

CASE XLIV.—Male, left hip; seven years; December 9, 1892; three and one-half years; unknown; general condition fair, one large abscess; hip-splint; anterior incision; ether; hip-splint;

January 31, 1897, general condition excellent, A. G. E. 165°, walks with slight limp, one and one-quarter inches shortening, no motion.

Case XLV.—Male, right hip; twelve years; December 15, 1891; one year; possibly infection from left hip; general condition poor, two discharging sinuses over left hip, abscess over right; plaster-of-Paris spica; anterior incision, marked osteomyelitis of femur, part of shaft removed, acetabulum diseased; ether; plaster-of-Paris spica; died December 25, 1891, of exhaustion following general tuberculosis. Same patient as Case XIV.

Case XLVI.—Female, left hip; fourteen years; December 16, 1892; seven years; unknown; general condition poor; in 1882 she was admitted to the hospital for supposed right hip disease, she recovered entirely, with use of liniments and tonics. In 1883 developed disease of the left hip, was treated with roller bandage. By 1885 had markedly improved, walked with slight limp, and had no atrophy or tenderness. Remained well until 1892. At this time A. G. E. was 170°, no motion in the joint; posterior incision. After removal of head and neck it was found that ramus of pubes was badly necrosed. Much of this was removed with sharp curette; ether; plaster-of-Paris spica, kept in bed; September 2, 1893, general health very poor, discharge from hip profuse, urine loaded with albumin, left the hospital. Died soon after.

Case XLVII.—Male, right hip; nine years; December 27, 1892; seven years; unknown; first two years of disease no treatment, next three years tonics, crutches, made good recovery except that A. G. E. was 110°, three inches shortening, and Gant's osteotomy was done to straighten the hip in 1892. Months after the operation a small sinus developed in the scar of operation wound, and patient's general health began to fail; posterior incision, portion of shaft of femur removed, large abscess in pelvic cavity opened; ether; March, 1893, general condition good, has four discharging sinuses, wearing a plaster-of-Paris spica. February 1, 1897, cannot trace.

Case XLVIII.—Male, right hip; six years; December 27, 1892; one year; fell from a wagon; general condition very poor; in July, 1892, an abscess was opened, diseased focus found in shaft of femur, and the same curetted. December 13th the sinus

was enlarged and a portion of the head, neck, and trochanter removed by curetting. December 27th, all remaining bone about the head, neck, and upper portion of the shaft removed; posterior incision; ether; plaster-of-Paris spica, curetting of sinuses on February 3d, March 7th, and May 12th; June 19, 1893, removed from the hospital. Died soon after.

Case XLIX.—Male, right hip; seven years; January 13, 1893; one year; unknown; general condition poor, has a large abscess in Scarpa's space; hip-splint; posterior incision; ether; plaster-of-Paris spica; May 13, 1893, general condition very poor, much discharge from the wound. Several suppurating glands in the groin. Removed from hospital. Died soon after.

Case L.—Male, right hip; seven years; January 21, 1893; two years; unknown; general condition very bad, large abscess over thigh, albumin in urine; for one year hip-splint; posterior incision; ether; hip-splint; December 30, 1896, general condition very good, one and one-half inches shortening, A. G. E. 150,° no motion in joint. Wears a short Thomas hip-splint, walks well.

Case LI.—Male, left hip; five years; February 24, 1893; duration and cause unknown; general condition very poor, large abscess over anterior portion of thigh; hip splint for a short time before admission; anterior incision; ether; plaster-of-Paris spica from date of operation until April 8th, then long Thomas hip-splint. April 18th, better drainage secured by a large posterior counter opening. April 25th an abscess opened. October 21st abscess opened. January 16, 1894, sinuses curetted. May 16, 1894, general condition very poor, spleen and liver much enlarged, general œdema marked; removed from hospital. March 17, 1897, general condition poor, one and one-half inches shortening, four discharging sinuses, no motion.

Case LII.—Female, right hip; four and one-half years; March 3, 1893; duration and cause unknown; general condition good, small abscess on upper and outer side of thigh; unknown; anterior incision; ether; hip-splint, Dow's brace; June 14, 1894, still wearing the brace, one and one-half inches shortening, leg in good condition. February 1, 1897, cannot trace.

Case LIII.—Male, left hip; five and one-half years; May 16, 1893; one year, has Pott's disease of the eleventh and twelfth

dorsal, no date given for the beginning of the spinal trouble; unknown; general condition fair, two abscesses over the joint and much infiltration of tissues about the hip; weight and pulley in bed for three months before operation, prior to that time no treatment: posterior incision and large counter opening for drainage; ether; Knight spinal brace and short Thomas hip-splint; September 12, 1893, general condition fair, one discharging sinus in incision wound, no motion at the hip, one and one-half inches shortening. February 1, 1897, cannot trace.

Case LIV.—Female, right hip; eight years; June 6, 1892; one year; no known cause; general condition very poor, much offensive discharge from one sinus; weight and pulley in bed, evacuation of abscess by aspiration, injection of iodoform and oil, free incision of abscess; posterior incision, wound packed with gauze; ether; stimulants. June 6, 1892, died from shock.

Case LV.—Female, right hip; four years; June 27, 1893; one year; a fall; general condition poor, large abscess over joint; weight and pulley in bed for six months, after that wore brace occasionally; posterior incision; ether; long Thomas hip-splint; left hospital June 23, 1894. Died one week later from exhaustion.

Case LVI.—Male, left hip; six years; July 14, 1893; one year; unknown; general condition bad, freely discharging sinus over joint; hip-splint, aspiration of abscess; posterior incision; gas; plaster-of-Paris spica; March 26, 1894, died of exhaustion.

Case LVII.—Male, right hip; six years; July 21, 1893; two years; a fall; general condition poor, a large abscess over trochanter and one in front of the joint; no previous treatment; posterior incision; ether; hip-splint. March 6, 1895, general condition good, A. G. E. 160°, A. G. F. 140°, cicatrix firm, one and one-half inches shortening, wears no apparatus. February 1, 1897, cannot trace.

Case LVIII.—Female, left hip; eight years; October 10, 1893; one year; unknown; general condition poor, large discharging sinus; plaster-of-Paris spica and hip-splint for one year; posterior incision, acetabulum badly diseased, freely curetted; ether; plaster-of-Paris spica, free stimulation. October 15th died of exhaustion.

Case LIX.—Male, right hip; ten years; October 31, 1893; six years; unknown; general condition poor, freely discharging sinus in Scarpa's space, has also left inguinal hernia; plaster-of-Paris spica; posterior incision; ether; plaster-of-Paris spica and hip-splint; October 11, 1895, Bassini operation for hernia, good result; one and one-half inch shortening, A. G. E. 155°, no motion, general condition good. July 31, 1896, left off all apparatus. March 1, 1897, general condition excellent.

Case LX.—Male, right hip; five years; November 10, 1893; one year; a fall; general condition poor, large abscess over joint; plaster-of-Paris spica, hip-splint, aspiration of the abscess; posterior incision, wound closed except for small drainage-tube; ether; plaster-of-Paris spica, December 9th operation wound completely healed; July 22d general condition very good, A. G. E. 160°, A. G. F. 130°, one inch shortening, goes about without apparatus, February 1, 1897, general condition very good.

Case LXI.—Male, right hip; five and one-half years; November 24, 1893; two years; a fall; general condition poor, hip very painful, abscess on posterior surface of right thigh; hip-splint and plaster-of-Paris spica; posterior incision; ether; March 20, 1894, abscess over the superior spine opened; June 2 abscess over trochanter opened; September 3, 1894, general condition very good, wearing a Dow's brace, A. G. E. 165°, one inch shortening. February 1, 1897, cannot trace.

Case LXII.—Male, left hip; thirteen and one-half years; January 1, 1894; one year; unknown; general condition very poor, has a large discharging sinus on outer side of thigh; weight and pulley in bed, opening of abscess; posterior incision, acetabulum found perforated; gas; plaster-of-Paris spica; January 13, 1894, developed tuberculous meningitis. January 20th, died.

Case LXIII.—Male, right hip; eight years; January 5, 1894; three years; unknown; general condition poor, abscess on outer side of thigh, and two discharging sinues; hip-splint; posterior incision; ether; plaster-of-Paris spica. February 20, 1894, died of tuberculous meningitis.

Case LXIV.—Male, right hip; four and one-half years; January 10, 1894; one year; unknown; general condition poor, large discharging sinus; hip-splint; posterior incision; ether; long

Thomas hip-splint; September 29, 1896, general condition good, slight discharge from one sinus, near the anterior spinous process. A. G. E. 180°. Very small range of motion. One inch shortening. February 1, 1897, cannot trace.

Case LXV.—Male, right hip; ten years; January 16, 1894; two weeks; unknown; general condition fair, a large abscess in Scarpa's space, has disease of left hip for two years, and an abscess, but this had closed and hip was nearly well; no treatment; posterior incision; ether; plaster-of-Paris spica. October 13, 1896, died from exhaustion.

Case LXVI.—Female, right hip; six years; February 2, 1894; six months; unknown; general condition poor, large abscess over joint; hip-splint; posterior incision; ether; hip-splint; January 31, 1897, general condition very poor, liver and spleen both enlarged, one discharging sinus, gets about without apparatus, A. G. E. 165°, three-quarter inch shortening, no motion.

Case LXVII.—Female, right hip; eight years; February 24, 1894; one year; unknown; general condition poor, abscess over the trochanter; frame and weight and pulley in bed; posterior incision; ether; frame; July 8, 1895, general condition poor, three freely discharging sinuses, A. G. E. 165°, one-half inch shortening. February 1, 1897, cannot trace.

Case LXVIII.—Female, left hip; four and one-half years; February 6, 1894; one year; unknown; general condition poor, large abscess over outer side of joint; no treatment; posterior incision, acetabulum found perforated; ether; stimulants. February 7, 1894, died from shock.

Case LXIX.—Female, left hip; four years; February 16, 1894; one and one-half years; cause unknown; general condition poor, albumin in urine, one large discharging sinus over the trochanter; hip-splint; aspiration of abscess, plaster-of-Paris spica; posterior incision; ether; plaster-of-Paris spica. March 19, 1895, died of exhaustion following general tuberculosis.

Case LXX.—Female, right hip; four years; April 24, 1894; two years, also has osteitis of the knee (left); unknown; general condition poor, large abscess over the trochanter; hip-splint; posterior incision; ether; hip-splint (Thomas); July 7, 1896, general

condition very poor, excision wound nearly healed, A. G. E. 170°, has a bad cough. February 1, 1897, cannot trace.

Case LXXI.—Female, left hip; seven years; May 1, 1894; one year; unknown; general condition very poor, two freely discharging sinuses; hip-splint, free incision of abscesses; posterior incision; ether; plaster-of-Paris spica; patient did very poorly after the operation. May 20th developed whooping-cough. June 16, 1894, died of exhaustion.

Case LXXII.—Female, left hip; eight years; June 5, 1894; four years; unknown; general condition good, large abscess on outer surface of thigh; hip-splint for one year, free opening of abscess; posterior incision; ether; plaster-of-Paris spica. Died in May, 1895.

Case LXXIII.—Male, right hip; eight years; June 8, 1894; five years; unknown; general condition poor; one year prior to admission, before that time no treatment; posterior incision; ether; plaster-of-Paris spica. August 21, 1894, died of tuberculous meningitis.

Case LXXIV.—Male, right hip; nine and one-half years; November 13, 1894; four years; unknown; general condition poor, has six discharging sinuses about the hip-joint; no previous treatment; posterior incision; ether; plaster-of-Paris spica and hip-splint; February 18, 1897, died of exhaustion. At time of death there were five discharging sinuses and five inches of shortening.

Case LXXV.—Male, left hip; seven years; November 20, 1894; two years; unknown; general condition poor, large abscess between the great trochanter and the crest of the ilium; first year of disease no treatment, second year hip-splint; anterior incision; ether; hip-splint; January 31, 1895, general condition very poor, has three discharging sinuses. Removed from the hospital. Died soon after.

Case LXXVI.—Male, left hip; nine years; December 4, 1894; three years; unknown; general condition poor, large discharging sinus; at first no treatment, last year hip-splint; anterior incision; ether; plaster-of-Paris spica and hip-splint. July 30, 1896, died of exhaustion.

Case LXXVII.—Female, right hip; five years; March 19,

1895; eight months; unknown; general condition poor, large abscess in gluteal region; long Thomas hip-splint; anterior incision; ether; plaster-of-Paris spica, Annin brace; February 26, 1897, general condition fair, has two discharging sinuses, A. G. E. 145°, three-quarter inch shortening, wearing hip-splint, 30° motion.

Case LXXVIII.—Male, right hip; nine years; March 19, 1895; one year; a fall; general condition poor, freely discharging sinus; weight and pulley in bed; Judson perineal crutch; aspiration and incision of abscesses; posterior incision, acetabulum perforated; ether; weight and pulley, hip-splint; March, 18, 1897, general condition excellent. Is in the country, and measurements cannot be obtained.

Case LXXIX.—Female, left hip; six years; April 9, 1895; one and one-half years; unknown; general condition fair, has one abscess on outer side of joint; first year no treatment, last six months plaster-of-Paris spica; anterior incision; ether; plaster-of-Paris spica, hip-splint; March 10, 1897, general condition fair, A. G. E. 170°, one discharging sinus, one-half inch shortening, no motion.

Case LXXX.—Male, right hip; three years; April 16, 1895; one year; unknown; general condition poor; plaster-of-Paris spica; posterior incision; ether; plaster-of-Paris spica; June 27, 1895, developed tuberculous meningitis. July 3d, died.

Case LXXXI.—Male, right hip; fourteen years; April 23, 1895; seven years; unknown; general condition very poor, has a large, deep femoral abscess; is said to have had treatment in first year of disease, since that time no treatment; posterior incision; ether; plaster-of-Paris spica; February 4, 1896, amputation of the thigh done with the idea of checking extensive suppuration. Died two hours after operation.

Case LXXXII.—Male, left hip; twelve and one-half years; April 23, 1895; five years; unknown; general condition poor, two discharging sinuses; hip-splint; posterior incision; ether; hip-splint; March 29, 1897, general condition good; last sinus healed in August; three inches shortening; A. G. E. 150°; walks well without apparatus, with high shoe, no motion.

Case LXXXIII.—Male, left hip; nine years; May 7, 1895; one year; unknown; general condition good, large abscess over

buttock and upper portion of thigh; Phelps' brace; not given; ether; stimulation. May 10, 1895, died of shock.

CASE LXXXIV.—Male, right hip; four and one-half years; May 7, 1895; sixteen months; a fall; general condition good, large abscess over the trochanter; hip-splint; posterior incision; ether; plaster-of-Paris spica, short Knight and Thomas brace; August 29, 1896, general condition excellent, wound entirely healed, A. G. E. 175°, one-half inch shortening. February 27, 1897, general condition excellent. Boy out of town, and measurements cannot be obtained.

CASE LXXXV.—Male, right hip; four years; May 7, 1895; one year; fell down a flight of stairs; general condition poor, large abscess over the anterior portion of thigh; plaster-of-Paris spica and hip-splint; anterior incision, which was closed by catgut, counter opening and drainage-tube; ether; hip-splint; sinus from drainage-tube entirely closed by November, 1895; January 4, 1897, general condition good, one-half inch shortening, A. G. E. 165°, A. G. F. 135°; wears no splint.

CASE LXXXVI.—Female, left hip; four years; May 21, 1895; six months; unknown; general condition poor, large abscess on outer part of thigh; plaster-of-Paris spica; posterior incision, wound partly sewed up; ether; hip-splint; July 21st, died suddenly of œdema of the lungs.

CASE LXXXVII.—Female, left hip; nine years; June 18, 1895; one and one-half years; a fall; general condition poor, freely discharging sinus; hip-splint, free opening of abscess; anterior incision, head of femur found loose in acetabulum; ether; hip-splint; August 21, 1896, general condition poor, liver enlarged, two discharging sinuses, A. G. E. 165°, one-half inch shortening. February, 1897, cannot trace.

CASE LXXXVIII.—Male, right hip; nine years; July 2, 1895; two years; unknown; general condition poor, large abscess over joint; plaster-of-Paris spica, hip-splint, weight and pulley in bed; posterior incision; ether; hip-splint, short Thomas splint; March 1, 1897, general condition good, sinus healed four months ago, A. G. E. 150°, thigh adducted, one inch shortening, no motion at hip; walks well with high shoe, no apparatus.

CASE LXXXIX.—Female, left hip; eight years; July 30,

1895; six years, had at first disease of right ankle, then hip-disease, then Pott's disease of dorsal region; unknown; general condition poor; plaster-of-Paris spica, hip-splint, and spinal brace; anterior incision, acetabulum found perforated; ether; hip-splint; January 23, 1896, general condition poor, sinus still discharging, one inch shortening, A. G. E. 180°, wearing Thomas hip-splint. January 1, 1897, cannot trace.

Case XC.—Male, left hip; six years; July 30, 1895; two years; unknown; general condition poor, discharging sinus over the joint; weight and pulley in bed, hip-splint; anterior incision; ether; hip-splint; March 5, 1897, general condition excellent, sinuses healed eight months after the operation, one and one-half inches shortening, A. G. E. 150°, no motion.

Case XCI.—Male, left hip; four and one-half years; October 15, 1895; one year; unknown; general condition poor, large abscess over joint; plaster-of-Paris spica; posterior incision; ether; hip-splint; February 1, 1897, general condition excellent, has one discharging sinus on outer portion of thigh, discharge slight, A. G. E. 180°, one-half inch shortening, no motion.

Case XCII.—Male, left hip; seven and one-half years; October 18, 1895; two years; no known cause; general condition good, large gluteal abscess; weight and pulley in bed for three months prior to operation, before that no treatment; posterior incision; ether; hip-splint; March 29, 1896, died of tuberculous meningitis.

Case XCIII.—Female, left hip; eight and one-half years; October 29, 1895; two years; symptoms first noticed one and one-half months after a fall from a stoop; general condition poor, large, deep abscess over the joint; plaster-of-Paris spica and hip-splint; posterior incision; ether; plaster-of-Paris spica, hip-splint; March 5, 1897, general condition fair, has six discharging sinuses, superficial veins of thigh enlarged, one inch shortening, A. G. E. 175°, A. G. F. 160°.

Case XCIV.—Female, left hip; six years; January 7, 1896; two years; unknown; general condition poor, has three freely discharging sinuses; hip-splint; posterior incision; ether; hip-splint; March 5, 1897, general condition poor, two discharging sinuses, two and one-half inches shortening, no motion, has dropsy, confined to bed, A. G. E. 165°.

Case XCV.—Male, right hip; five years; January 29, 1896; one and one-half years; unknown; general condition poor, three freely discharging sinuses; hip-splint, weight and pulley in bed, opening of abscesses; posterior incision; ether; hip-splint. December 1896, died of exhaustion.

Case XCVI.—Male, right hip; eleven years; February 4, 1896; four years; unknown; general condition poor, two discharging sinuses; plaster-of-Paris spica, hip-splint, opening of abscesses; posterior incision; ether; hip-splint; March 9, 1897, general condition excellent, sinuses all closed, one and one-half inches shortening, A. G. E. 170°, no motion

Case XCVII.—Male, right hip; ten years; February 4, 1896; three and one-half years; unknown; general condition poor; unknown; posterior incision; ether; hip-splint; August 20, 1896, general condition good, sinus closed, two inches shortening, A. G. E. 180°, wearing short Thomas splint and high shoe. February 1, 1897, parents live in the country, do not reply to letters sent.

Case XCVIII.—Female, right hip; fifteen years; February 4, 1896; six years; a fall; general condition very poor, several discharging sinuses; hip-splint, plaster-of-Paris spica, weight and pulley in bed; posterior incision; ether; plaster-of-Paris spica. December 5, 1896, died of exhaustion.

Case XCIX.—Female, left hip; ten years; March 10, 1896; five years; unknown; general condition very poor, large abscess over the outer side of thigh; hip-splint. February 12, 1895, Gant's osteotomy to correct flexion deformity. October 21, 1895, abscess appeared on outer side of joint; posterior incision; ether; hip-splint; February 1, 1897, general condition good, A. G. E. 155°, no motion in joint, cicatrix good and firm, walks very poorly, one inch shortening.

Case C.—Female, right hip; five years; March 24, 1896; four years; a fall; general condition very poor, large abscess over joint; no treatment for three years, for one year plaster-of-Paris spica and hip-splint; posterior incision; ether; hip-splint; May, 1895, wound entirely healed. December 30, 1896, general condition good, wearing hip-splint, one-half inch shortening, A. G. E. 175°, no motion.

Case CI.—Male, right hip; eight years; March 31, 1896; two years; a fall; general condition poor, free discharging sinus; hip-splint, antisyphilitic treatment internally and externally. Has very severe discharge from nose, ears, and mouth; posterior incision; ether; hip-splint, antisyphilitic treatment; January 2, 1897, general condition poor, A. G. E. 180°, 10° motion in joint, one and one-quarter inches shortening, liver enlarged, nose and ear in bad condition.

Case CII.—Male, right hip; eight years; April 6, 1896; one year; a fall; general condition very poor, large abscess over joint; hip-splint and plaster-of-Paris spica; anterior incision, acetabulum involved; ether; hip-splint; May 22, wound entirely healed, A. G. E. 180°, A. G. F. 110°. August 4th, general condition excellent, A. G. E. 180°, A. G. F. 90°, still wearing brace. February 1, 1897, cannot trace.

Case CIII.—Male, right hip; six years; April 28, 1896; two years; unknown; general condition very poor, discharging sinus in gluteal region; plaster-of-Paris spica, incision of abscesses. October 8, 1895, diseased bone found at junction of sacrum and coccyx, thoroughly curetted; anterior incision; ether; wire cuirass; March 1, 1897, general condition poor, liver two inches below free border of ribs, has three discharging sinuses, A. G. E. 170°, one-quarter inch shortening, no motion.

Case CIV.—Male, left hip; eleven years; May 12, 1896; two years; unknown; general condition poor, abscess on upper and posterior portion of thigh; first year no treatment, second year hip-splint; posterior incision; ether; hip-splint; March 5, 1897, general condition poor, sinuses entirely healed by August 5, 1896. Still wearing hip-splint. A. G. E. 180°, 40° of motion, one and one-quarter inches shortening.

Case CV.—Male, right hip; twelve years; May 19, 1896; three years; unknown; general condition poor, one discharging sinus over joint and abscess on outer side of thigh; hip-splint, aspiration of abscess; posterior incision; ether; hip-splint; March 9, 1897, general condition good, A. G. E. 165°, three discharging sinuses, one-half inch shortening, no motion. Reported in Transactions of American Orthopedic Association, vol. ix. p. 162.

Case CVI.—Female, left hip; seven and one-half years; May

26, 1896; two years, has Pott's disease of three months' standing; unknown; general condition very poor, two discharging sinuses, liver much enlarged; hip-splint, opening of abscesses; posterior incision, acetabulum much involved; ether; hip-splint, spinal brace; March 1, 1897, general condition good, A. G. E. 160°, one-half inch shortening, still wearing brace, sinus healed for several months past, no motion.

Case CVII.—Male, right hip; nine years; June 2, 1896; three years; a fall; general condition poor, discharging sinus just below the anterior superior spine; plaster-of-Paris spica and hip-splint; anterior incision; ether; hip-splint; January 11, 1897, general condition good, one inch shortening, A. G. E. 155°, one discharging sinus, no motion.

Case CVIII.—Male, left hip; ten and one-half years; June 9, 1896; three years; fell from a wagon; general condition poor; plaster-of-Paris spica, hip-splint, opening of abscesses; anterior incision, acetabulum perforated; ether; there was much oozing from the wound, and two days after operation it had to be again packed with gauze. December 11, 1896, hip-splint applied and boy sent to the country. Has two discharging sinuses, general condition fair; February 24, 1897, just recovered from measles, has a freely discharging sinus on outer side of thigh; on inner side of thigh an abscess; general condition poor; A. G. E. 160°; one-quarter inch shortening; no motion.

Case CIX.—Male, right hip; twelve years; June 9, 1896; five years; unknown; general condition very poor, freely discharging sinus over joint, marked infiltration of the thigh; plaster-of-Paris spica, hip-splint, opening of abscess; anterior incision; ether; hip-splint; January 16, 1897, has three slightly discharging sinuses, general condition good, 10° of motion in joint, one and one-quarter inches shortening, A. G. E. 155°, wearing Annin brace.

Case CX.—Female, left hip; seven years; June 23, 1896; one and one-half years; unknown; general condition poor, freely discharging sinus on the anterior surface of thigh; hip-splint; anterior incision, acetabulum found perforated, necrosis of ilium and pubes; ether; hip-splint; January 29, 1897, general condition good, no motion in joint, one-half inch shortening, abscess opened to-day on outer side of thigh, wearing Annin brace.

Case CXI.—Female, right hip; seven years; June 27, 1896; duration and cause unknown; general condition poor, large abscess over the joint; unknown; anterior incision, wound sewed up; ether; hip-splint, curetting a sinus that formed after wound had healed; January 20, 1897, has given up the hip-splint; general condition good; one-half inch shortening.

Case CXII.—Male, left hip; eleven years; June 30, 1896; five and one-half years; unknown; general condition very poor, large amount of albumin in urine, six dischargirg sinuses; no treatment for three years, then hip-splint, opening of abscesses, long Thomas hip-splint and crutches; anterior incision; gas; general stimulation; July 10, 1896, died of acute uræmia.

Case CXIII.—Female, right hip; ten years; July 3, 1896; one year; a fall; general condition fair, large abscess over the joint; hip-splint, aspiration of abscess; anterior incision, acetabulum diseased; ether; hip-splint; February 1, 1897, general condition poor, freely discharging sinus, one-half inch shortening, A. G. E. 170°, no motion.

Case CXIV.—Male, right hip; ten years; July 8, 1896; three years; unknown; general condition poor, large abscess over joint; hip-splint; posterior incision; ether; hip-splint; January 7, 1897, general condition fair, one inch shortening, three discharging sinuses, one in perineum, one in groin, one on outer side of thigh, discharge trifling; wearing brace.

Case CXV.—Male, left hip; nine years; July 21, 1896; one year; unknown; general condition fair, deep abscess over the anterior portion of joint; hip-splint; anterior incision; ether; hip-splint. January 2, 1897, died of exhaustion.

Case CXVI.—Female, right hip; six and one-half years; July 24, 1896; three months; a fall; general condition poor, large abscess over the joint; weight and pulley in bed; anterior incision; ether; hip-splint; January 21, 1897, all sinuses closed; general condition good; A. G. E. 180°; has free motion in all directions; wearing Annin brace; one-half inch shortening.

Case CXVII.—Female, right hip; seven and one-half years; July 24, 1896; one year; unknown; general condition poor, freely discharging sinus over joint; hip-splint, opening of abscesses; anterior incision, acetabulum eroded; ether; hip-splint; December 24,

1896, general condition excellent, cicatrix firm, A. G. E. 180°, one-quarter inch shortening, walks well without apparatus.

Case CXVIII.—Female, right hip; five years; July 28, 1896; one year; a fall; general condition poor, abscess over outer side of joint; hip-splint; anterior incision; ether; hip-splint; March 15, 1897, general condition poor, one sinus discharging profusely, A. G. E. 165°, 10° motion, marked spasm, three-quarter inch shortening; wearing Annin brace.

Case CXIX.—Female, left hip; thirteen years; August 14, 1896; four months; unknown; general condition poor, hip held at 90°, over the sacrum a large abscess; no treatment; anterior incision; ether; hip-splint; February 1, 1897, reports general condition very poor, several discharging sinuses, much emaciation, measurements cannot be obtained, living in a distant State.

Case CXX.—Male, right hip; five years; August 25, 1896; one year; no known cause; general condition poor, deep abscess in front of joint; plaster-of-Paris spica; anterior incision; ether; hip-splint; January 11, 1897, general condition good, one and one-quarter inches shortening, A. G. E. 180°, 10° motion; wearing Annin brace.

Case CXXI.—Male, left hip; six years; September 1, 1896; one year; no known cause; general condition poor, abscess over outer side of joint; weight and pulley in bed, plaster-of-Paris spica; anterior incision; ether; plaster-of-Paris spica, hip-splint; December 1, 1896, sinus closed. March 5, 1897, general condition good, A. G. E. 160°, A. G. F. 90°, one-quarter inch shortening.

DISCUSSION.

Dr. De Forest Willard, of Philadelphia, said that the brilliant statistical results as regards life and the utility of the limb, that were obtained from excisions in England, could not be expected here, owing to the fact that American surgeons operated comparatively late. In England many joints are excised that in the United States would recover with equally useful limbs. He believed, however, that our mechanical treatment was most useful,

and he did not despair of a case until there was evidence of streptococcus or staphylococcus infection. Then he thought an excision would shorten the disease and lessen the liability to complications, such as amyloid disease of the liver and kidneys. Very frequently it was only necessary to remove the head and neck of the femur, leaving the trochanter with its important muscular attachments. In the advanced cases there were certainly many advantages on the side of the operation over the slower process employed by nature.

Dr. Willard exhibited a skiagraph from one of his cases six years after an excision. In this young man only the head and neck had been removed. There were three inches of shortening; he retained every motion of the hip perfectly, and could stand and balance himself on the toes of a single foot.

Dr. J. D. Griffiths, of Kansas City, said that every now and then acute cases were met with affecting the epiphysis, and it became necessary to excise, even though we were reluctant to do so. He had had a few cases in recent years that had seemed to demand such interference.

Dr. Herbert L. Burrell, of Boston, said that he had been deeply interested in this subject, because the plan of allowing a child to sink away in spite of so-called mechanical treatment, and without operative interference, seemed to greatly limit the sphere of usefulness of the orthopedist. During the last four or five years he had come to the conclusion that excision was indicated when the symptoms and physical signs showed that the patient was irremediably losing ground. He fully appreciated the value of the so-called American orthopedic treatment by mechanical means, yet we should not overlook the occasional bad ultimate results. Quite recently he had had under his care a case in which, within ten days after the acute onset of a tubercular process in the head of the femur, he had made an incision and drained the joint. The child was weak and sickly, yet by this simple operative interference its condition was greatly improved. Within a fortnight he was able to get the child out of bed, and he felt perfectly confident that he had saved the little one from an ultimate excision—possibly from something even more serious.

Dr. Ridlon asked Dr. Townsend if, after a period of two to four years, he had observed breaking down of the scar without any muscular spasm indicating a return of the bone-disease. He had himself seen two such cases. One had been operated upon about five years ago by Dr. Owens, and good motion secured. A splint had been applied to give support to the weak limb. After four years the scar broke down, yet there was no muscular spasm. Another case, operated upon by Dr. Farnham, yielded an excellent result at first; but now, after two years, the scar was broken down. There had been, however, no return of muscular spasm.

Dr. Ridlon showed a skiagraph of a man in whom there was very active hip-joint disease. The man had been limping at intervals for three or four years before the diagnosis had been made, and had been in bed now for eight or nine months. Improvement had been steady, but slow. In this case there was a brawny condition, not only of the groin, but of the entire thigh and also of a portion of the leg below the knee. The thigh was an inch larger than the other side. Apparently, from the skiagraph, the shaft of the femur was not involved. This was the only case in his experience in which the shaft of the bone, being free from disease, the affected limb had been larger than the normal limb. Several surgeons had seen this case, and had agreed in the diagnosis of hip-joint disease.

Dr. Shaffer said that he had reached the conclusion that excision of the hip-joint was an operation which was very rarely called for. He ventured to say that a large proportion of the cases reported in the papers this morning would not have been excised if they had been under his care. He would make a plea that all orthopedic hospitals should have a country branch, for with such surroundings the need for excision would often disappear. He had found that his patients from the country, even in private practice, did better than those living in the city.

Dr. Sherman said that, so far as he could see, the objection to early operation was entirely in the stunted growth of the limb and, sometimes, the associated adduction. The abductor muscles had been robbed of their lever by the removal of the trochanter,

head, and neck, but the adductors were always potent, even though there were no head and neck. The shortening could be easily compensated for by a high shoe, but the adduction could not be so easily compensated for. This adduction did not occur in all cases, but we could not say beforehand in just what cases it would occur. He spoke of the result in one of his cases of excision—a boy who could ride a bicycle and dance, and enjoy himself like other boys. He now had under his care many children with abscesses upon whom he would have operated a few years ago, but he had refrained from operation because he could not be sure that he could secure a good result. As the general condition of the children was fair, and their abscesses showed no mixed infection, he did not feel disposed to interfere by operation. Three or four years ago he had published a short series of cases illustrating the results of excision, and he proposed to have these cases traced again, in order to ascertain the ultimate results.

Dr. R. H. Sayre said that it seemed to him just as narrow to say that we should never exsect as to say that we should excise in every case within six weeks, as did some of our foreign *confrères.* He did not think there could be any question that a certain number possessed such poor vital resistance that, unless artificially aided, they could not get rid of the products of the disease. There were very few cases requiring excision, yet he believed there were a few that must come to excision or speedily reach the graveyard. Regarding septic conditions following excision, he said that, provided the patient were not thoroughly aseptic before, free drainage should keep the patient from becoming septic afterward. As to amputation instead of excision in cases where a large amount of the shaft of the femur was involved, he would say that he had seen one case operated upon by Dr. Spencer, who removed nine inches of the femur with a better result by far than could have been obtained by amputation. The chances of preventing septic infection were better by splitting open the femur and packing it than by trying to drain the medullary canal through the trephine hole.

Dr. L. A. Sayre had stated the case clearly, many years ago, when he declared that by the time excision of the hip was recognized as a justifiable measure the profession at large would have

become so conversant with the diagnosis and proper treatment of hip-disease that the operation would be very seldom required.

THE PRESIDENT referred to the marked change of sentiment in the profession that had taken place within the last twenty years. Formerly exsection was much more commonly performed than now, and it was largely the result of the influence of conservative mechanical treatment that it was less often done at present. Dr. Townsend had clearly stated the chief indication for exsection—*i. e.*, as a life-saving measure. Some years ago he had placed himself on record as performing excision for this reason, and this only. He would like to ask Dr. Townsend how, in the acetabular cases, amputation would be preferable. In all of these cases there was always considerable sepsis, and many sinuses were present. Even in these cases many surgeons had seen good results eventually from mechanical and general treatment. He would also like to emphasize what Dr. Shaffer had said regarding the great value of climatic treatment in tubercular joint and spinal disease.

DR. LOVETT said that the mortality rates given in the two series of cases were significant because of their close correspondence. Regarding the climatic treatment, he said that they had been accustomed in Boston to make use of it through the aid of the country branch of the Children's Hospital at Wellesley. In a certain number of the cases that he had considered in his paper even the climatic treatment had not been neglected. He had endeavored to establish the real status of late excision. Having done this, we could intelligently consider the question of early excision. He believed there was a type of case that should be subjected to early excision, as stated by Dr. Griffiths and Dr. Burrell. The exact type had not yet been formulated, but it could not be doubted that there were a few such. It was probable that very decided progress would be made in this direction, and it should be our effort, therefore, to definitely formulate the type of case demanding such early excision.

DR. TOWNSEND said, in reply to the question of Dr. Ridlon, that he had seen quite a number of cases in which the sinuses had

reopened. He had come to believe that it was due to a small portion of necrosed bone that had worked its way to the surface. It did not necessarily indicate a recurrence of the tuberculous disease. Regarding amputation in cases of acetabular disease, he referred to his experience in Bellevue Hospital, in the service of the late Dr. James R. Wood. This celebrated surgeon paid no attention to antiseptics, but amputated rapidly, and carefully drained off the discharges. Drainage could be easily secured by amputation, and certainly this could not be affirmed of cases of excision where it was well known that the question of drainage was a very difficult one. He had known very septic cases to be improved immediately by amputation, where there was every indication of a fatal result before the amputation. The whole question of the indications for excision hinges, on the word "irremediable" as employed by Dr. Burrell. Our results would necessarily depend very largely upon the particular type of disease, for cases varied very greatly, just as did cases of pulmonary consumption. In the future, he thought, excision would be less frequently performed, but would be done earlier and with better results.

The President referred to a case recently reported in New York by Dr. H. Lilienthal—one of acute osteomyelitis of the knee. This patient had become extremely septic, and as a last resort the injection of the streptococcus serum had been done. The girl made a prompt and remarkable recovery. He mentioned this as a hint to those who had opportunities of investigating serum-therapy in connection with cases of orthopedic surgery. He thought it might prove of great service in the acute cases.

TREATMENT OF TORTICOLLIS.

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In the treatment of anterior torticollis the complete division of the sterno-mastoid muscle and contracted bands above the deep layer of fascia, and overcorrection after operation to secure as much elongation in the divided structures as is possible, is so obviously the fundamental treatment that mention of it is not necessary. The condition after successful treatment of this is well known—that of a possible overcorrected position of the head, which before was prevented by the contracted bands; but when the muscles are at rest or when the patient's attention is not directed, the head quickly falls back into the old positon, and therefore, retention is necessary, which, if not carried out persistently, recontraction will occur and the deformity return.

There is but one explanation of this tendency of the head to persist in the old position, and habit is not a sufficient explanation, since habit is simply the indication of some underlying condition.

The point which it is desired to bring about is that this condition is one clearly analogous to that found in lighter forms of lateral curvature, either the postural forms, or, if the case is older and the duration longer, it resembles the cases which show structural spinal change. The etiology is widely different, but the structural changes in the deeper parts are essentially the same; that is, if a part of the spine is held continually in a position of deformity, structural changes occur which of themselves cause the continuance of the malposition. The necessary precaution in after-treatment is to keep the head in position of overcorrection to stretch the deeper structures, and dependence is usually placed on retention by apparatus, keeping the parts in condition of stretch, and a more

perfect antagonism is thus established when the head is in the position desired; in other words, the parts are in a condition of physiological rest when the head is in a normal position, and the movement in either direction is accomplished with equal ease. The value of mechanical treatment is so well recognized that it is almost an axiom, and its value is not to be questioned, but it is not to be assumed, however, that this means only will accomplish this end. We have at our disposal the two methods of overcoming deep contraction—that of continual retention and that of intermittent stretching—carried on at intervals by massage and gymnastic exercise.

The steps in the correction of anterior torticollis are three:

1. The thorough division of the sterno-mastoid muscle and contracted structures which lie above the deep layer of fascia, by which the obstacle to placing the head in correction or overcorrection is overcome.

2. The further stretching of the deeper structures which are beyond the use of the knife, and which until thoroughly stretched exert a constant force to pull the head toward the old condition of distortion, and the retention in a condition of correction or overcorrection until such change has occurred in the structures of the deeper part of the neck and about the spinal column that the structures are adapted to the normal position.

3. The correction of the habit of position, so that the muscles, by involuntary control in physiological rest, hold the head in a straight position instead of in distortion, in which they have been trained during the development and growth, by continuance in the malposition. The importance of this is not to be overlooked, especially in older cases, where we may expect this to be more pronounced, and also where we may look for more intelligent effort on the part of the patient. These conditions can be met by the retention in overcorrection for a sufficiently long period of time, but the apparatus has the disadvantage of being cumbersome and unsightly; and if in selected cases this can be equally well accomplished without this, it is by all means advisable to do so. This is done in other regions of the spine, and with sufficient surety to warrant the trial here, and it is in reference to this method of after-treatment that these cases are cited to illustrate what may be done by persistence in the method. It is by no means to be claimed that

this is a substitute for the ordinary surgical treatment of severe or even milder cases of torticollis, but that in selected cases, where the treatment can be carried out, that the retention and further correction may be accomplished without the means of apparatus; and these cases are cited simply to illustrate what has been accomplished in each of the four classes of cases, which are ordinarily met with.

CASE I. *Operation after treatment by massage and forcible exercise.*—Patient, aged twelve years, first came under observation some months after operation. After treatment had been neglected there was contraction of the sterno-mastoid, so that the face could not be brought to the middle line, nor the head to the vertical position when the shoulders were level. In the best position the head was turned in thirty degrees of rotation, and when the head was placed in a vertical line the shoulder was elevated two inches. An attempt was made in this case to see what could be accomplished by a persistent effort with massage and exercise to overcome the recontraction and improve the carriage of the head. The treatment was carried out by one-half to one hour exercise of massage three times weekly and extended over a period of nearly a year. At the end of this time the contraction of the sterno-mastoid had been entirely overcome, the habitual position was that in a straight line there was no rotation of the face, and it was possible for the patient by her own effort to bring the head into a position of full overcorrection. Treatment in this case extended over a long period, but the child lived at a distance, and it was not possible for her to have the treatment at shorter intervals.

CASE II. *Torticollis with marked deformity in a young child; operation and after-treatment by massage.*—Patient, aged six years, with marked deformity. In this case, unfortunately, no record of the amount was taken. Operation by the usual method and thorough division of all structures above the deep fascia. Head incased in plaster and held for one month. At the time of removal head held for the time in a straight position. Overcorrection was possible to nearly that of the motion of the other side. Massage and gymnastics were carried out three times a week for

awhile regularly, and later the treatment became somewhat interrupted. At the time of writing, nine months after operation, no sign of recontraction, and head is held straight and is easily placed in that of overcorrection. The case is cited as illustrative of the ease in which a young case is treated where there has not been a marked change in the shape of the deeper structures.

Case III. *Severe torticollis in a young adult; after-treatment by massage and gymnastics.*—Patient aged seventeen years. Deformity had existed since infancy; very marked contraction of sterno-mastoid, especially of clavicular portion. Distinct distortion of face. When shoulders were level the face was turned forty-five degrees and deflected from vertical position the same amount. Operation by open incision. All deep structures were thoroughly divided and the head put in as nearly a correct position as possible. In this case full correction was not possible at the time of operation on account of the patient's condition, the cause of this to be spoken of later. After the usual time of retention in plaster this was removed, and the head was then in nearly the straight position. No contraction of the sterno-mastoid; the deeper structures, however, prevented the overcorrection of the head. Treatment by massage and gymnastic exercise was begun immediately and carried on for three months, one hour a day, three to four times weekly. At first it was impossible in this case for the head to be brought beyond a straight line without decided pain and marked faintness. In three months the amount of mobility had increased so that overcorrection of the head was possible, and the habit of position was so much improved that the head was held voluntarily nearly in a straight line. After this time the exercises were carried out twice a week, and at the end of five months the head was that of easy overcorrection without the pain and stiffness previously encountered. The face was level and the position of the shoulders was even. This case was cited to show the result by this method, when persisted in, in a case of unusual severity.

Case IV. *Treatment by massage and exercises without previous operation.*—Patient, aged eight years. The deformity had existed three or four years. History before that time uncertain. Head

held in deformity, face turned in rotation about twenty degrees, elevation of shoulder one-half to two inches in best position. No previous treatment. It was attempted in this case to see what could be done by this same method without the operative treatment of thorough division. Treatment carried out for nine months, although with less regularity than the other cases cited. In this case, however, there was no improvement whatever at the end of this time. This case was cited to illustrate the necessity of preliminary operative treatment.

The method used in this consisted of both massage in the over-corrected position and of gymnastics, which tend of themselves to bring a strain on these structures, and the use of the part in as nearly as possible the corrected position. For the former, massage was done with the head over a roll, with the face turned toward the opposite direction, the head drawn to the opposite shoulder, and the chin was as much as possible depressed, which brings the greatest strain on the sterno-mastoid muscle and also upon the deeper structures which tend to hold the head in the old position. In this position massage and pressure are given along the course of the sterno-mastoid and the deep posterior muscles. Second: With the shoulders in this position the patient grasps the table with the hand on the side toward which the head is turned, and the forcible rotation of the head is made by the assistant, first forward, then toward the side of the contraction, then with backward bending of the head to rotation on the opposite side, by which the stretch of these parts is made.

The exercises are such as to put the shoulder and the shoulder-muscles on the stretch, with the head turned as far as possible toward the opposite position; and the patient is then made to do such exercises as bring strain on the muscles in this position. For instance, the patient is made to stand with the head drawn in this position, and a heavy dumb-bell is used to swing from above the head downward, forward, until the arm is at the side. This is done forcibly, so as to exercise the muscles in their overstretched position. It is sometimes necessary in this that the head is held by the assistant; otherwise the tendency is for the patient to turn the head toward the placid shoulder, in order to prevent the strain which it is intended to make.

An obstacle was met with in the correction of one of the cases—Case III.—which to the writer's knowledge has not been mentioned in the article on this subject, and is of sufficient importance to be borne in mind in operations on older cases. This happened during the fixation of the head after operation. The case was one of long standing and marked contraction. After division of all the superficial parts there was felt to be considerable resistance to the movements of the head beyond the middle line. While the head was held in a position of slight overcorrection while a plaster was being applied, the pulse suddenly became poor, the color bad, and the respiration shallow, and this suddenly on a condition that had previously been excellent. This condition was marked enough for the strain of the neck to be relieved and the work suspended for the moment, when these symptoms disappeared. After a few moments the head was again placed in a position of overcorrection, and the symptoms immediately returned. They were sufficiently marked to be somewhat alarming, so that the operation of applying the plaster was necessarily suspended for awhile. It was necessary to be content with less correction than might otherwise have been obtained. In three days the plaster was removed from the shoulders, leaving the portion of the head untouched, and the head brought into position of greater correction. Although the condition since the operation had been entirely satisfactory, the patient having walked about out-of-doors, the result of this was almost immediate faintness, the same slowing of the pulse and change in color, which did not disappear until after the tension on the neck was relieved. At the end of a week another attempt was made, with the same result. At this time this condition was looked for and tried several times; but whenever the head was placed in a position much beyond that of correction these symptoms immediately appeared. After removal of the plaster, whenever overcorrection was carried beyond a certain point these symptoms always were induced and continued during after-treatment for some time. It seems that there can be but one explanation for this phenomenon, and that is that the vagus-nerve was involved in the contraction, which was of marked degree, but protected from stretching by the contracted muscle; that when these were released enough motion was allowed to put the nerve in a

state of tension, resulting in irritation; that it was not due to interference with the circulation was shown by the absence of syonosis or of the sign of any mechanical obstruction, and also by the appearance of the same symptoms whenever this was subsequently attempted during the period of after-treatment.

It is to be distinctly understood that this method of treatment is not in any way urged as a substitute for the treatment for torticollis without operation, as is shown by the case cited, in which it was tried simply as a check, in which the treatment was a failure. It is, however, claimed that in selected cases, in which after-care can be relied upon, that this method is fully as reliable as the retention of the head in apparatus.

DISCUSSION.

Dr. L. W. Hubbard, of New York, said that he had recently been treating a marked case of congenital torticollis in a girl twenty-eight years of age. The right shoulder was elevated more than an inch; the right sterno-cleoid mastoid was shortened one and one-half inches; the whole right side of the face was considerably atrophied, giving a very peculiar expression to the face. The extreme deformity could be seen in the photographs which he exhibited. The case was operated upon on January 5, 1897, by the open incision, dividing the sterno-mastoid in the middle, the trapezius, and all the contracted tissues. The parts were thoroughly stretched under ether and the head put up in plaster-of-Paris in an over-corrected position. After about ten days, the wound having healed, the plaster-of-Paris was removed, and further correction was made before reapplying the plaster-of-Paris. Subsequently a spinal apparatus with a Taylor chin-piece was substituted for the plaster. This was worn about two months. The girl came each day for manipulations similar to those described by Dr. Brackett. The photographs, taken on February 10th, showed the amount of improvement. At the present time she held the head in good position and could move it easily in all directions. She had not worn an apparatus for about two months. There was still some elevation of the right clavicle and also some lateral curva-

ture of the cervical spine. This had been very marked before the operation. He would indorse Dr. Brackett's remarks regarding the very great importance of stretching, manipulations, and massage in these cases of persistent torticollis.

Dr. Gillette asked Dr. Brackett if in the case in which these singular symptoms were observed there was any marked deformity or rotation of the vertebræ in the upper dorsal region.

Dr. Shaffer said that he had been much interested in the conservative treatment of torticollis. His earlier efforts had not been very satisfactory, and he had reached the conclusion that division of the muscles was the first essential step in the treatment. The cases presented had revived his interest in this subject. It seemed to him that certain cases should be relieved by the systematic massage described. Forcible intermittent traction could be applied with good results to other parts of the body than the feet; the great difficulty was in getting the proper points for extension and counter-extension.

Dr. William J. Taylor thought there were three classes of cases of torticollis, viz.: (1) those in which the cutting of the sternomastoid was occasionally sufficient; (2) those in which it was necessary to resect the spinal accessory nerve just before it entered the muscle; and (3) those in which it was necessary to cut the nerves supplying the posterior muscles of the neck. After operation he had used with success practically the same method of gymnastic exercises as had been described in the paper.

Dr. Blanchard said that in his experience with torticollis it had always been necessary to begin with an operation. The chief point of interest in the paper under discussion was in regard to the possibility of the rapid cutting off of the circulation to the brain by overcorrecting the head. It was a novel complication, and had hitherto not received attention.

Dr. A. J. Steele, of St. Louis, believed that in chronic cases operation was absolutely necessary. He applied plaster-of-Paris

both around the head and trunk independently, leaving the neck free; then two long strips of wire gauze were curved over the head, the end of one coming down in front of the chest, and the other at the back; these were fastened to the head by additional rolls of plaster bandage. While an assistant overcorrected the head, more layers of plaster bandage were carried around the chest, so as to confine the ends of the gauze, thus holding the head firmly in the overcorrected position. This seemed an efficient and comfortable position. The treatment by manipulations was laborious and often not properly carried out; hence he suspended the patient by the occipito-mental strap, carrying one end far out on the bar and the other near its centre, which tilted the head in the desired and improved direction.

Dr. Lovett said that in two cases that he had seen it had seemed to him that there was the reverse of torticollis—in other words, cases which might be described as congenital elevation of the shoulder. In the first case the scapula was drawn up, giving rise to a condition resembling a posterior torticollis, in which, instead of pulling the shoulder down, it had pulled it up. By a long incision and dissection most of the muscles connected with the scapula were cut through. The result was not good. Subsequently he had seen a child in whom the sterno-mastoid and posterior muscles were absolutely shortened. There was little or no tendency to displacement of the head, but if the head were put in position of torticollis the shoulder would come down. Therefore, in certain cases, for some unknown reason, the shoulder was pulled up, and these cases should be recognized in connection with torticollis as at present understood.

Dr. Shaffer said that not long ago he had seen a case which he could only classify with torticollis. Instead of unilateral contraction there was a double contraction of the sterno-mastoid muscles, producing a forward position of the head very much like that of Pott's disease. He had never seen but this one case. It would seem that instead of a lesion of the nerve on one side, with degeneration of the muscle, there was a double lesion of the nerve and muscle.

Dr Brackett, in closing, said that he did not advise this as the treatment for torticollis, but only as an excellent treatment subsequent to operation. He did not think it was sufficient in itself, except in very slight cases, to overcome the strong contraction of the torticollis; but having once overcome this chief obstacle, the massage and exercises would accomplish the desired purpose.

THE PROGNOSIS OF HIP DISEASE UNDER EFFICIENT TREATMENT.

By LeROY W. HUBBARD, M.D.,
NEW YORK.

When I presented this subject before the Orthopedic Section of the New York Academy of Medicine, one of the members, in discussing the paper, remarked that he thought I had expressed too much concern in regard to the prognosis in cases of hip disease; that the surgeon should be satisfied with the knowledge that he had employed the best means at his command in the treatment of his patient, and should not be troubled about the ultimate result.

It is possible, perhaps, for the surgeon to look at the matter so philosopically, but I am afraid such a view would be cold comfort to the parents and friends, and would hardly be accepted by them as an excuse for a poor result.

I think most of us will acknowledge that the prognosis, both as to result and the length of time necessary in the treatment of every case of hip-joint disease, is of great importance to those immediately interested in the patient.

After a diagnosis has been made the first questions asked are: "Will my child get well? Will he be deformed and limp for the rest of his life?" And "How long must he be under treatment?" These are practical and important questions for the orthopedist also, and many times the answers to them will puzzle him. He is in a certain sense between Scylla and Charybdis. If he is positive in his prognosis, and predicts a good result after a short course of treatment, while he may encourage the parents to hope, should the case progress unfavorably and the treatment be prolonged, they will soon become discouraged and lose faith.

On the other hand, should the surgeon frankly state at the outset

that the results in this disease are uncertain, that he is unable to state positively what the outcome will be, and that the course of treatment will probably be a long one, he runs the risk of being thought ignorant of the special cases which he professes to treat, and confidence and hope, without which the surgeon is handicapped, are destroyed at the start.

I must confess that the more cases of hip-joint disease I see the less confidence I feel in my ability to say what the final result in a given instance will be or how long must the treatment be kept up to effect a cure.

Brief histories of two cases will explain my reason for making this statement. In May, 1894, a little girl was brought to my office for examination with a history of a slight, persistent limp lasting for several weeks. There had been no traumatism, no pain, and her general health was excellent. Her father had died a few months previous of tuberculosis of the lungs. Muscular spasm was present, but to such a slight degree and only in the extremes of motion that I kept the case under observation before making a positive diagnosis. As the limp and spasm did not disappear under rest, I determined to protect the joint, feeling that I had a case of hip disease in about the earliest stage in which it is possible to discover it. Apparatus was applied and the treatment began. The mother of the child is intelligent, devoted to her interests, and my instructions were carried out faithfully, and the child herself is gentle, tractable, and easy to control. Frequent examinations were made, and the apparatus was always found properly adjusted.

For eighteen months there was not the slightest unfavorable symptom except slight swelling in the groin, which disappeared in a few weeks; motion became free, the spasm disappeared, and I encouraged the mother to believe that soon the brace would be removed, and the result would be a perfect restoration of the function.

During this period there had been no accident except a fall of about a foot from a hammock, which was scarcely remembered by the mother. Suddenly, motion in the joint became restricted, spasm increased until the joint was locked, and a slight degree of flexion and adduction took place. Although the deformity has

disappeared under careful treatment, there is scarcely any motion in the joint, and the best result I now hope for is anchylosis in a good position.

About the same time I saw another patient who gave a very different history and presented widely different symptoms. The disease had evidently existed for more than a year, but had not been recognized. There was a history of intense suffering, the child was pale, anæmic, and nervous to the point of hysteria. The thigh was flexed to an angle of 125° and strongly adducted; there were positive signs of an abscess on the outer aspect of the thigh, the joint was extremely sensitive, and the reflex muscular spasm was so intense that the slightest motion was not permitted. The family history was excellent. My prognosis was a long course of treatment, the result considerable shortening and very limited motion. But under treatment the deformity soon disappeared, the abscess was absorbed, the muscular spasm diminished, and to-day there is no spasm, only one inch shortening, and motion which lacks only a little of the normal.

Have we, then, any data or guides by which we can foretell, with approximate correctness, the final result in a given case of hip disease and predict the probable length of treatment?

Of course, I refer now exclusively to those cases which can be absolutely controlled by the surgeon and the treatment carried out efficiently and thoroughly. The cases which occur in hospital and dispensary practice are, as a rule, so irregular in attendance and the home care so neglected that they cannot serve as a basis for determining results under efficient treatment.

Taking up, first, the question of mortality in hip-joint disease, I think that here it must be conceded by everyone the prognosis is very good among the cases in the class to which I have referred. While statistics seem to show that the mortality averages about 30 per cent., yet these figures are taken from the reports of public institutions, in many of which the cases were not treated at all or the treatment was very poor.

The most complete reports of cases in private practice are those of Drs. C. Fayette Taylor and Dr. Lewis A. Sayre. The former reported ninety-four cases with two deaths, which could in any way be connected with the disease, and the latter eight, the mor-

tality in each being approximately 2 per cent. It may be stated, therefore, that under efficient treatment a child with hip disease has about as good a chance of reaching adult life as other children not so afflicted.

Eliminating the question of mortality, the range of motion which will be present in the joint after the disease has been arrested, the amount of shortening and deformity, and finally the duration of treatment, are the features of each case which concern us most. The published books and journal articles on the subject of hip-joint disease are of very little value in enabling us to give a prognosis on these important points. As a rule, we find general statements to the effect that if a case is seen early the apparatus will probably be necessary for about two years; if the disease is more advanced, from three to six years will be required; that the amount of shortening varies from one-half inch to four inches; that a few get well with perfect restoration of function, more with fair motion; the majority with little motion, and a considerable number with anchylosis, and that a certain amount of deformity remains in a large proportion of the cases.

Young states that when the disease makes its appearance after puberty it is less manageable, more extensive, and more fatal than when it occurs at an earlier period. He also adds: "In the arthritic variety of the affection the prognosis is most favorable, being more serious in the femoral and still more grave in the acetabular variety." But he does not give any means by which the surgeon may diagnose to which variety a given case belongs. Possibly a further study of these cases by means of the Roentgen rays may enable us to determine the exact location of the inflammatory process at a very early period. I do not know on what grounds Dr. Young bases his prognosis. Certainly in my experience those cases in which the disease has developed after puberty have done remarkably well and the results have been very satisfactory.

In regard to the location of the inflammation as a factor in prognosis, the consensus of opinion is that in the vast majority of cases the disease begins in the head of the femur, and theoretically, at least, it would seem that if the case were seen early and the inflammation limited to the bony structure, the prognosis, both as to

time and joint function, ought to be better than when the joint surfaces are involved in the outset.

Dr. R. W. Lovett, in a paper read before the Association in 1892, divided cases of hip disease into four types or classes, which he thought could be recognized clinically. These are:

1. The destructive form, where the disease is rapid, severe, and but little influenced by treatment. Occurs in children of marked tubercular inheritance and poor vitality. Prognosis bad both as to life and future condition of the patient. Many die from meningitis or exhaustion. Those who survive have generally anchylosis and great shortening. These cases are comparatively uncommon, the symptoms are well marked, appear in rapid succession, and the prognosis is usually readily made.

2. The painful form, when pain is a prominent symptom and exacerbations are common. This form the author considers the most common type, and regards the course as shorter and the prognosis more favorable as to function and deformity than the third type.

3. The painless form, where pain is either absent or a very unimportant symptom. In these cases the onset is slow and insidious, and there is little or no pain even many weeks after other symptoms are present. Dr. Lovett claims that the course of these cases is much slower than the preceding, and the final result generally a stiff joint.

4. The transient or ephemeral form. Under this head he describes cases which present the usual signs and symptoms of hip disease, but recover perfectly after a few months of treatment. In my experience the painless form is by far the most common. The cases which I have seen comparatively early rarely have had pain as a prominent symptom, and when pain was present it disappeared when treatment was begun. I cannot either agree that the course of the cases is slower or the results less satisfactory. In regard to the fourth form, we have no means of diagnosticating them from the graver forms, and as it is not common these cases cannot have much influence in determining our prognosis.

In the report of Dr. Sayre's cases, mentioned above, there were 301 in which he knew the result. Of these 71, or 23 per cent., were given as cured with perfect motion; 142, or 47 per cent.,

with good motion; 83, or 28 per cent., with good motion; and 5, or 16 per cent., with anchylosis. In the six cases reported in full, where the motion was perfect, the apparatus was worn from two to two and a half years. The amount of shortening is not mentioned. Of course, the amount of shortening will vary with the individual case, but I believe under efficient treatment it rarely ought to exceed two inches, even though suppuration take place. If a case recovers with marked deformity, and by this I mean sufficient to be noticed in walking, the fault must be laid at the door of the surgeon or of the friends for not carrying out his instructions. If a case is carefully watched and examined at each visit, and if, when the slightest flexion, adduction or abduction is found, the patient is put to bed until the deformity is overcome, the result will be a good position, even though the joint may be anchylosed.

In estimating the prognosis in a given case the hereditary history, the development of the symptoms, and the general appearance of the child have great weight. If there is a marked tubercular family history; if the disease has begun insidiously without a definite traumatism, and the child shows poor vitality, as indicated by the bluish sclera, pale skin, and fine, dry hair, I usually give a very guarded prognosis, both as to time and result, even though the disease is in a very early stage. If, on the other hand, the family history is free from taint, the child robust, and especially if there is a distinct history of traumatism, the prognosis is more favorable.

In conclusion I would say that with our present knowledge of hip-joint disease a definite, positive prognosis as to time and result in any given case is impossible. The most that can be said with any method of treatment, when carried out in the most efficient manner, is that the child will probably recover; that there will be little or no deformity, not more than two inches shortening, some motion in the joint, and that the time necessary to accomplish this result will be at least two years.

DISCUSSION.

Dr. Ridlon said that he was interested in the statement that adults did better than children, for, while in New York City he had been under the impression that they did not do as well as children. Now, however, having had more experience with adults in the last five years, he felt convinced that the latter had done as well or better than the children in the same period.

Dr. Blanchard said that, in his experience in Chicago and neighboring States, the proportion of adults giving good and quick results was much larger than of children.

Dr. Sherman referred to the possibility of confusing a sarcoma of the hip, occurring in an adult, with a tuberculosis of the hip. A year ago Dr. Gillette had reported similar cases. Last winter, the speaker said, he had had a case in which the clinical evidence was entirely in favor of a hip-joint tuberculosis. The patient was put in bed for the management of a rigid deformity which existed. He improved in his general condition, but the local symptoms got worse. This was at first difficult of explanation, but on doing an excision which had been decided on in consultation, it was found that the case was one of sarcoma. The thigh was subsequently amputated, and the pelvis and other diseased structures removed. He died that afternoon. The specimen showed that the sarcoma had invaded the head of the bone and also the pelvis, thus giving rise to joint rigidity, and this explained the clinical mimicry of tubercular-joint disease.

Dr. Gillette said that in one of the cases reported last year he had met with the experience referred to by Dr. Ridlon, viz., the joint symptoms entirely disappeared, although the limb remained large. The patient died of osteosarcoma in four months.

Dr. V. P. Gibney presented a specimen in connection with subject of prognosis in hip-joint disease. The specimen had been

taken from a child who had appeared to be practically cured at one time, and who had left the hospital in good condition. A sinus had reopened, and about this time the child developed scarlet fever, and was transferred to another hospital. On its return its condition was very bad—even too bad for an amputation. After a week or ten days the child died. The specimen consisted of the acetabulum, and the head, neck, and part of the shaft of the femur, and it showed extensive osteomyelitis.

GLUTEAL BURSITIS.

By E. G. BRACKETT, M.D.,
BOSTON.

Although inflammation of the bursa about the hip under the gluteal muscles is well known to occur, it frequently is not recognized, or at least has not been given the attention due it. Presenting, as this condition does, the limp, pain, and some symptoms which are referred to in the joint, they may easily be in their early stages overlooked for early hip disease; and as it is claimed to extend and later involve the hip-joint, this early condition may be easily lost sight of.

Pathologically, it is an inflammation, usually, if not always, tubercular in character, one of the bursæ lying under the glutei muscles. It is recognized, in a well-marked case, as a swelling upon the upper part of the buttock, which is well defined in outline by palpation, and presenting more or less amount of deep fluctuation, dependent on the amount of the fluid. When exposed by a dissection there is seen a well-defined sac, which can be separated without difficulty along its upper surface and sides, but below with much more difficulty, as it is apparently here more adherent, and lies so deeply that it is not easy of access.

The symptoms can be understood from the presence of the tumor in this region, and may be regarded in the first place as irritative on the joint from the contiguity of the inflammatory process; second, from the mechanical interference with the play of the muscles in this region; and, third—a possible cause—that of the pressure from the action of the muscles through the tumor on the sciatic nerve below. This, in one case observed, would seem to be very possible, as it was so placed that pressure would easily be made in this region through the crowding down of the tumor by the contraction of the muscles above.

The cases are of special interest from the fact that they may closely resemble hip disease in its early stages. Again, because it may later invade the joint and result in tubercular joint process, and also in that early operative interference gives in a very large majority, if not all of the cases, a satisfactory result, and in a short time. In the very early stages the expectant treatment may be tried, and in two cases which have been under observation a retrogression has taken place; but if a distinct amount of fluid can be detected by palpation, and if the symptoms have persisted for a considerable time, it is doubtful if it is expedient to delay, but rather at once to follow out the radical measures of freely opening and removing as much of the sac as may be possible. The sac is so deeply placed and so near the joint that extension is more likely to be inward than outward, and the result consequently serious.

The field of operation is best approached by an incision over the buttock parallel to the fibres of the gluteus maximus muscle, a little to the inner side of its outer border. Perhaps the region may be exposed by drawing to the inside this muscle, but usually the better way will be found to separate the fibres, which opens the region to the edge of the medius. The tumor is then easily exposed, and the upper part of the sac can be readily separated from the fascia. From the upper view it appears as part of a well-defined, rounded swelling, and would lead one to expect that complete extirpation might be easily accomplished; but further dissection may show the tumor spread out in several directions, and sometimes extensively, so that to attempt to completely remove all parts of the sac would necessitate too extensive a dissection, and it is doubtful then if some portions would not be left. That it is sometimes multilocular is shown by bands stretched across the anterior, which are apparently the remains of partition walls. In some cases, as in the last one reported, the tumor lies directly on the capsule of the hip-joint, so that the neck and the head of the femur can be felt under the finger, separated only by the lower wall of the sac and the capsule, and, in fact, the movement of the head and neck is readily seen when the leg is rotated. The proximity to the joint is another reason for not attempting too radical removal, as the accident of cutting the capsule, and thus exposing the interior of the joint to the infection of the tubercular process, is obvi-

ously too serious a one to need mention, and there is no reason to suspect that there is any connection with the joint originally. Thorough drainage is necessary, and packing the cavity for a few dressings is to be recommended. In all the cases treated healing has followed removal of the packing, and no sinus has remained, nor has the wound reopened. Restriction of the use of the limb is advisable by the use of crutches and a high sole, but apparatus either for traction or the removal of weight is not necessary.

Case I.—C. H., aged eleven years. April, 1894. Symptoms: temporary limp for eight or nine months; pain during previous winter in the back and side of the leg; lameness increased by excessive exercise; limitation of flexion of extended leg; contraction of hamstring tendons. This case shows a very slight prominence over the region of the buttock and a slight tenderness in manipulation in this area. Under partial rest and avoidance of active exercise the symptoms entirely disappeared.

Case II.—C. R., aged ten years. February, 1897. Symptoms: limp for several weeks; pain under knee after excessive exercise; no night-cries; limitation of extreme flexion. Limitation of flexion of extended leg; limitation of rotation outward of flexed leg; walks with knee bent. Swelling can be detected under the upper part of the gluteus muscle. Symptoms and swelling both disappeared in this case under rest to leg by use of crutches.

Case III.—S., aged six years. Typhoid fever in September, 1896. Limp noticed soon afterward. Subsequent symptoms: limp, pain, occasional night-cry; swelling appeared about March over upper part of gluteus muscle. Operation April 8th; sac easily found, containing pus and thickened wall membrane. Abscess-cavity was packed with gauze and allowed to heal slowly. Opening closed in about six weeks, and child was kept on crutches for six months. One year afterward nothing abnormal could be detected about the hip-joint.

Case IV.—D., aged four years. May, 1895. Symptoms: limp; limitation of hyper-extension; pain in the knee; limitation of flexion of extended leg; no atrophy. December: slight atrophy; rolling limp; limitation of flexion; hyper-extension; rotation outward of flexed leg; limitation of flexion of extended leg. Operation: sac exposed, thoroughly curetted and packed. Sinus healed

in about six weeks. Pathological report shows the tumor to be tubercular. When last seen, one year later, hip normal, as shown both by the examination and absence of all symptoms. The child had meanwhile developed a spina ventosa in foot on same side, but which was subsiding rapidly.

Case V.—M., December, 1894. Symptoms: limp for nearly a year; occasional night-cry; permanent flexion, forty degrees; limitation of motion in flexion; complaint of hip dates back only about two weeks; case has shown occasional attacks of pain, but never acute; accurate history could not be obtained. Operation in January, 1895; bloody fluid evacuated; no distinct sac found; healed in four weeks; no subsequent symptoms. One year after developed hip-disease in other leg.

Case VI.—R., aged eight years. Swelling in upper gluteal region; limp; limitation of flexion and flexion of extended leg. Treatment was not followed. In the course of four or five months had sudden development of joint symptoms, and later the case could not then be distinguished from one of ordinary hip disease.

Case VII.—H., aged four years. Symptoms date back about three to four months. Early suspected to be that of hip disease. Symptoms those of limp; pain referred to the knee; slight flexion; slight atrophy. April, 1897: condition shows limitation of extreme flexion, of hyper-extension, rotation outward of the flexed leg. Swelling noticed over upper part of buttock, with sense of deep fluctuation. Operation near the inner border of the gluteus muscle; fibres separated, bringing to view the area at the edge of the gluteus medius muscle. The sac was exposed and dissected around a part of its area and separated on the upper part of its surface. The lower part was found to be firmly adherent. The contents were evacuated, and it was then found that it extended to the middle line as far as the sacrum, upward to the crest of the ilium and below as far the trochanter. This was thoroughly opened and the interior exposed to view, and it was found to be lying directly over the hip-joint, but apparently not connected, separated, however, only by the sac-wall and the capsule. This was thoroughly curetted and the cavity packed. As this is a recent case the outcome cannot be given now, but at the time of writing the sinus is gradually closing and the hip is not involved.

The symptoms which have been found in this affection will bear a brief mention.

First, in all the cases seen they have existed for some time, usually months; have not been severe and not subject to the usual remission met with in early and slowly developing hip disease. Excessive exercise aggravates them for the time being, but they subside rather rapidly. Limp has been early and persistent. Pain is not prominent, is referred to the back of the leg and under the knee, does not last into the night, and night-cries do not apparently occur. In one case there was the history of an occasional cry that did not exist while the case was under observation.

Limitation of motion: The most prominent noticed has been of extreme flexion, rotation outward of the flexed leg and of flexion of the extended leg, which last is due to contraction of the hamstrings, and which has caused in three of the cases a slight degree of permanent flexion, and which was clearly not due to contraction of the psoas and iliacus. Spasm is so slight that it may be disregarded.

And, finally, the pressure of deep fluctuation in the upper part of the gluteus region. The swelling may be seen by careful comparison of the two sides, and palpation gives deep resistance, fluctuation with rather sharply defined boundary.

DISCUSSION.

Dr. Gibney said that a good many years ago he had seen two or three cases in the hospital of undoubted gluteal bursitis. He recalled the fact that on exploratory puncture serum was withdrawn. The hip was blistered, and recovery was speedy. He said that he recalled very vividly one or two cases of bursitis of the anterior part of thigh. In one of these the hip was subsequently involved, and the case ran the usual course of hip-joint disease.

Dr. R. H. Sayre called attention to the fact that these bursæ were sometimes connected with the joint. He had seen such a case, in which a long, tail-like process communicated with the joint.

THE PRESIDENT said that he had at the present time under his care a patient who came to him with a very large swelling of the gluteus. There was a history of traumatism, but there were very few symptoms at that time. Eventually lordosis and rigidity of the spine developed, and now there was no question about the existence of Pott's disease. It was rather rare, the speaker said, for psoas abscess to burrow down posteriorly.

DR. GILLETTE referred to an old case of hip-joint disease that had been treated by Dr. Sayre many years ago. The case had been practically cured. About four years ago this person developed a great deal of pain in the buttock, and especially along the great sciatic nerve. On making an incision he had been astonished to find an abscess which was present in the bursa and which did not connect with the joint. The patient made a perfect recovery.

RELAPSES IN CLUB-FOOT.

By E. H. BRADFORD, M.D.,
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Although the treatment of club-foot has now been brought to a state of excellence, yet occasionally relapses are seen; as however, the pathological anatomy is now so well known the causes of relapses can be readily determined.

Club-foot is a congenital dislocation at the medio-tarsal articulation, with resulting changes in the soft tissues and bones or cartilaginous structures. The relation between the scaphoid and the neck of the astragalus are well understood and easily borne in mind. The replacement of the misplaced scaphoid is easily effected by means of tenotomy, open incision, and by forcibly replacing bone, but the relation of the cuboid to the os calcis is frequently masked, lying deeper than that of the scaphoid and astragalus, and may in treatment be but partially corrected. The distortion of the os calcis at its anterior aspect, if not corrected, increases and forms an obstacle to the complete restoration of the cuboid to the normal position, although the rest of the deformity may have been corrected. This difficulty is not easily detected by external inspection, or even manipulation. In many instances the foot can be apparently brought into position, the scaphoid slipping over the astragalus and the fourth and fifth metatarsal acquiring an unusual outward mobility on the front of the cuboid, supplementing the defective motion at the medio-tarsal articulation. The cuboid is lower than it should be, and still further aggravates the twist in the front of the foot.

Where the cuboid is cartilaginous and the ligaments are well stretched, the defect at the anterior portion of the os calsis can be overcome by forcibly correcting the foot and retaining it in the corrected position by means of a plaster-of-Paris bandage, care being taken, however, that the cuboid be restored to place, and in time it

will be found that the cartilaginous abnormality in the shape of the os calcis is gradually changed under corrected pressure.

Where distortion of the head of the os calsis is great, no amount of mechanical treatment can overcome this obstacle, if it is of bone, and if the ligaments are strong, binding the bones in a distorted position. It is manifest under these circumstances that the rational treatment is a removal not of the astragalus or cuboid (as has sometimes been done), but of a part of the projecting portion of the head of the os calcis. This operation is not a difficult one, does not mutilate the foot, and, under the conditions which are here mentioned, is thoroughly remedial.

This condition in the os calsis in relapsed feet results from two causes: First, the natural defect, fortunately, not always present in club-foot, and, second, following imperfect correction. In correcting club-feet in small children it is at times difficult to obtain a firm hold upon the os calcis, and in twisting the front of the foot outward it is easy to overlook the position of the cuboid, to forcing the fourth and fifth metatarsals over the cuboid, instead of the cuboid over a distorted os calcis to which it is firmly bound. Where this takes place complete correction is not made, and the natural deformity of the os calcis, which originally cartilaginous, and overcome under proper conditions, becomes permanent and aggravated in the change from cartilage into bone. Furthermore, apparatus is frequently used which exerts the pressure on the outer side of the foot, not upon the head of the os calcis, forcing the head into its normal position, but upon the cuboid or the fifth metatarsal; in other words, in front of the medio-tarsal articulation and tending to aggravate the deformity. It should always be borne in mind that the os calcis is frequently distorted in club-foot, lying obliquely with the heel pointing inward and the anterior portion pointing outward.

Where this condition has been allowed to persist until the distortion of the os calcis has increased, and the ligamentous attachment holding it in its distorted position becomes strong, for perfect correction radical means are necessary. This can be done thoroughly by means of an osteotomy of the head of the os calcis.

The operation is not a new one, and has been described before, but some of the details are not as generally known as is desirable.

After complete stretching or division by tenotomy, force, or open incision of the contracted tissue on the inner and under side of the foot, tendons, ligaments, and fasciæ, if it is found that the front of the foot cannot be brought to a perfectly corrected or over-corrected position, an incision should be made on the outer side of the foot, passing from behind the external malleolus forward and downward. The incision should be a curved one, and the chief convexity should be at the forward portion of the os calcis. This incision should reach to the bone, and should expose the peroneal tendons. These can either be drawn to the side, or divided, to be stitched later. The upper portion of the incision should reach behind the external malleolus, and should extend far enough up to allow sufficient retraction of the flap to give room for the osteotomy. After the bone has been reached, the periosteum divided and pushed aside, an osteotome should be inserted sufficiently far back to remove a sufficient amount of bone. The direction of the insertion of the osteotome should be such as to allow the placing of the cuboid after the bone has been removed to a normal position. This step of the operation requires some nicety and judgment, as it is of importance that the front plane of the bone after the wedge has been removed should be in the direction of the normal facet of the front of the os calcis. A wedge-shaped portion of bone should be removed from the anterior surface of the os calcis, and the cartilaginous ends saved in order to allow a proper amount of motion between the cuboid and the os calcis after recovery. The wedge-shaped portion of bone that should be removed should be ample and enough to allow the replacement of the front of the foot in a normal or over-corrected position and the restoration of the direction of the os calcis to the proper one.

The wound should be carefully washed out to remove any fragments of bone that may have been left, and subsequently stitched; the tendon of the peroneus longus, if divided, being stitched. The foot should then be dressed with proper dressings and fixed in an over-corrected position by plaster bandages according to the ordinary rules in osteotomy.

Whether this operation should be done in connection with an osteotomy of the neck of the astragalus, and with an open incision at the same sitting, is a matter of judgment in each case. In my

earlier operations this was done at two successive operations. In the later ones, however, both procedures were done at the same time. If carefully done the danger of cutting off the blood-supply is slight, and the patient avoids the necessity of a second operation, and can find a more speedy cure.

Where the operation is neatly done, but little mutilation of the foot is necessary, much less than required by the removal of the astragalus, and entirely satisfactory results can be obtained, as have been abundantly proved by clinical results both published and unpublished.

FIG. 1. FIG. 2. FIG. 3.

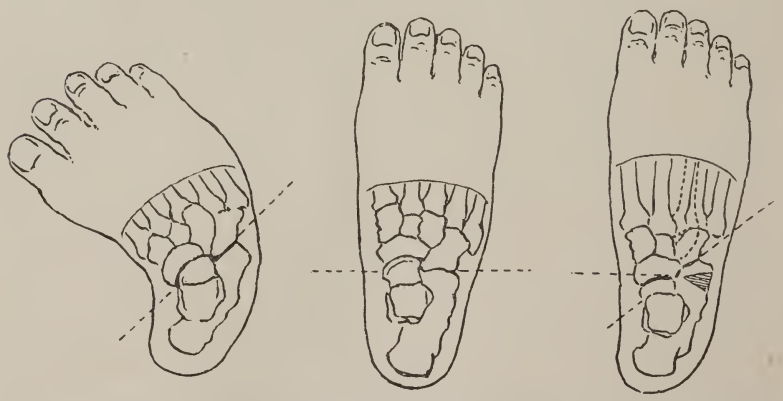


FIG. 1.—Diagram. Anatomy of club-foot, showing distortion of the heads of the astragalus and os calcis, and abnormal line of the medio-tarsal articulation.

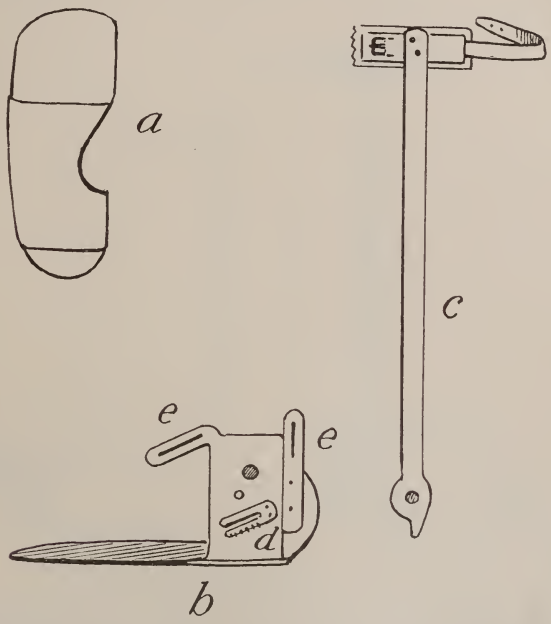
FIG. 2.—Diagram of normal foot, showing the normal line of the medio-tarsal articulation.

FIG. 3.—Imperfectly corrected club-foot. The scaphoid is slid over the head of the astragalus, but the cuboid is locked in an abnormal position by the abnormal head of the os calcis. It is underneath the corrected cuneiforms. The line of the medio-tarsal articulation is normal in front of the astragalus, but abnormal in front of the os calcis. Correction is made possible by a wedge-shaped resection of the neck of the os calcis.

Although perfection in result may be aimed at, it is only attained by a careful attention to detail. Certain errors are easily made. First, the neglect of thorough asepsis. This sometimes occurs through excessive bleeding, which passes through the dressing and the plaster bandages, and affords a means of entrance for sepsis. This can be prevented, first, by stopping all hemorrhage before the application of the plaster, and for this reason operating without Esmarch constriction is advantageous; second, by the protection of the dressing by thoroughly sterilizing impervious material. Where

staining has taken place it is necessary either to cut a window in the plaster and apply antiseptic dressing, or to remove the old plaster, reapplying it again after any sepsis has been removed by douching and washing. As thorough drainage is furnished, no evil results follow beyond a delay in the healing, and some pain follows imperfect sepsis, provided thorough antiseptic treatment is immediately used.

FIG. 4.



a. sole-plate of retention shoe ; *b.* side view of sole-plate of retention shoe with securing clasp, *d*, and metal loops, *e e*, for steadying straps ; *c.* upright.

The second error which is sometimes made is the failure to remove a sufficient amount of bone and in such a direction as will correct the deformity. This is only avoided by a certain amount of experience in the operation, or by bearing in mind the exact position of the anterior facet of the os calcis in a normal as well as in a deformed foot. With care, however, and painstaking this difficulty can be overcome. It is to be borne in mind that it is not necessary to remove a large portion of bone, and that it is not necessary to

remove bone from any of the tarsal bones with the exception of the astragalus and the os calcis; in many instances linear osteotomy of the neck of the astragalus is sufficient.

The third error is imperfection in placing the foot in a corrected position after operation. The foot should be thoroughly dressed with aseptic dressings, the foot being first protected by cotton placed around the toes, the foot, heel, and up the leg in such a way as to pre-

FIG. 5. FIG. 6.

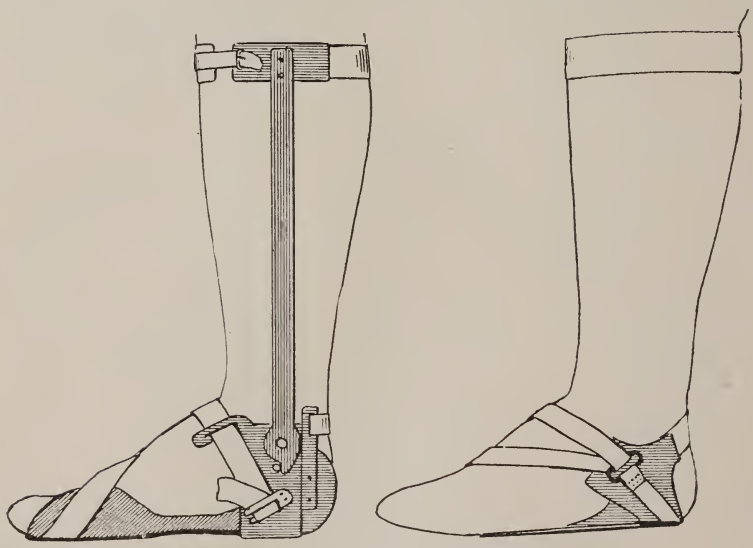


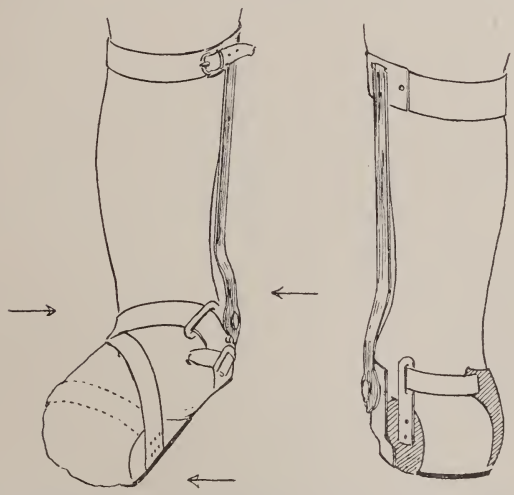
FIG. 5.—Side view of the retention appliance applied inside of the leg.

FIG. 6.—Side view of the retention appliance. Outside view, showing the leather side piece, with a metal ring, through which the strap passes, exerting side pressure upon the os calcis.

vent sloughing. Plaster bandages are then applied, and while they are hardening the foot is held in a corrected position, the plaster should be placed up the whole length of the leg, and above the knee, which is slightly flexed, in order to secure the bandage from twisting. The foot should be held so that the cuboid is pressed upward and outward, and the front of the foot pressed outward and upward, counter-pressure being applied on the astragalus on the outer and upper side, and the os calcis twisted into its normal position. If this is not thoroughly done healing will take place in a faulty

position. Where there is doubt it is advisable to remove the plaster, and recorrect. Treatment can be carried out with a plaster-of-Paris bandage until the foot is thoroughly healed, and also until locomotion has been re-established. In place of a plaster bandage other apparatus, like a silicate bandage, can be used, but these furnish awkward appliances. It is desirable that a walking appliance should be used for six months following the operation, which intereferes but little with the movements of the foot. As many of the appliances are so arranged, it is manifest that if a pressure

Fig. 7.



Front view. The strap starts from the inside of the great toe and passes obliquely to the outside through the loop on the outside, is then brought across the ankle through the metal loop and secured in the clasp. If the great toe tends to rise, an additioual strap, indicated by the dotted line, can be added, passing across the toes and buckled to a small buckle attached to the sole-plate.

from the outside, forcing the foot inward, be applied at the cuboid, it will simply serve to drive that bone as a wedge, preventing complete correction. The pressure on the outer edge of the foot should be applied to the head of the os calcis as well as to the astragalus, but on the cuboid. For this purpose the apparatus depicted in the accompanying illustration will be found to be useful, and can be worn within the boot, does not disfigure, and allows motion of the ankle.

DISCUSSION.

Dr. Sherman said that he had been using for some years past a retentive shoe having a very similar arrangement of straps for controlling the heel.

Dr. Hubbard asked if Dr. Bradford used adhesive plaster to the leg.

Dr. Bradford replied that in most cases he had not found this necessary.

AN EXAMINATION OF HUMAN GAIT.

By E. H. BRADFORD, M.D.,
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If the gait of pedestrians be watched it will be noticed that there are variations, not only according to age, size, and strength, but also in different individuals. These variations are at first so confusing that any classification seems impossible, but on further examination it will be seen that certain types can be determined.

If anyone walking is seen from the side, it will be noticed that the body is kept erect if the gait is a leisurely one. The thigh is advanced by the action of the psoas iliacus, rectus, and tensor vaginæ muscles; the weight is first thrown upon the heel of the projecting leg, and the body brought forward by the push of the foot of the rear leg, which is bent at the knee. The projecting leg as it strikes the ground is usually straight—that is, not bent at the knee. This may be termed the erect gait or straight-leg gait. In faster walking, or in a slow gait in feeble persons, and in children, the weight of the body is frequently used as a means of propulsion. The individual leans forward, his body weight propelling him, being kept from falling to the ground by the interposition of the front leg, which is usually bent at the knee as the heel strikes the ground. The gait differs from a run in that it is a true heel-and-toe gait, and not upon the front of the feet alone, as is the case in a run. This may be classed as the forward or bent-knee gait.

In strong and rapid walking both of these types are combined, the front leg is protruded as far as possible and held straight—*i. e.*, not bent at the knee as the weight strikes the ground. The foot of the rear leg is used to propel with a vigorous push; the knee of the rear leg is straight or but slightly bent at the final strong push of the foot, the weight of the body falls forward, the trunk is

inclined forward, acting by its weight as an additional propelling force.

The angle the foot (when the heel first strikes the ground) forms with the ground, looked at from the side, varies in individuals. It is necessarily greater in long strides than in short strides and in the erect and the bent-knee gait. It has been stated that in normal gait the projecting foot strikes the ground with the whole of the sole, rather than with the heel alone. Instantaneous photography has disproved this, except in an artificial gait—the parade step in the German army.

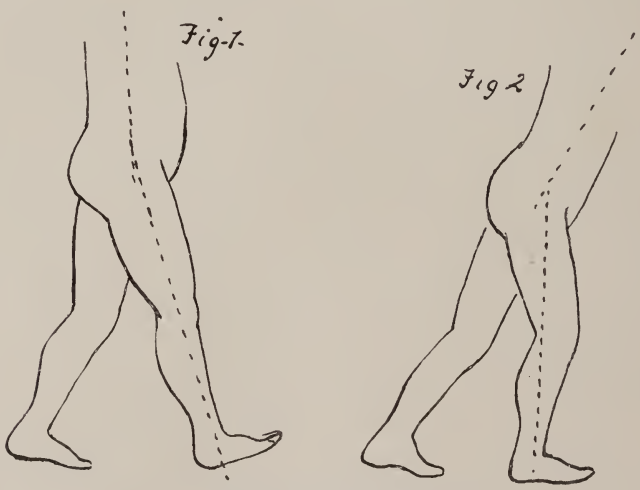

FIG. 1.—Diagram representing erect gait.
FIG. 2.—Diagram representing forward gait.

If those who are walking are looked at in front as they approach it will be seen from a little distance that a noticeable angle will be made by the axes of the feet. This angle of divergence varies in different individuals, some feet being nearly parallel, others with a wide divergence. This varies at different portions of the gait. It is widest as the rear foot is first moved forward and when the heel of the front foot is placed upon the ground.

The divergence of the feet varies according to the rapidity of the gait, and whether the gait is the erect, or the forward gait, and also varies in different parts of the step. When the heel of the

projecting foot strikes the ground the foot is turned out somewhat, the degree varying in individuals. When the front of the foot is brought to the ground the foot will be seen to turn slightly to the inside, as the weight is thrown farther forward on the sole. It may be noticed that individuals sometimes toe-out slightly with one foot, and toe-in with the other, toeing-in being accentuated as the front of the foot is brought to the ground. Individuals who have never worn shoes walk much straighter than those the front of whose feet have been confined by shoes. The moccasin- and sandal-wearing races are trained to walk using the front of the foot a great deal, and they either toe-in or walk straight; but in a leisurely gait, even among barefooted people, a certain amount of toeing-out can be seen, though this is not the case in rapid walking.

The toeing-in is partly due to the inward divergence of the first metatarsal separating itself from the second metatarsal when the front of the foot is strongly used. This inward mobility is, perhaps, a vestige of earlier arboreal traits, existing to a larger degree in monkeys and anthropoid apes, where the prehensile foot is adapted to the arboreal activity. It is determined in man by the shape of the articulation of the first metatarsal with the first cuneiform, as compared with that of the second cuneiform and second metatarsal, which is universal in man, and is to be seen in the prehistoric skeleton found in the cave in the South of France (Museum of Comparative Anatomy, Jardin des Plantes, Paris). It is also seen in a skeleton of an African pigmy (South Kensington Museum).

An examination of photographs of barefooted and moccasin- and sandal-wearing people (Dalmatian, Turks, Egyptians, Somalis, Congo Negroes, Soudanese, Zulus, Dahomeys, Druses, Hindoos, Hill Country Indians, Chinese, Japanese, Javanese, natives of Australia, Patagonians, Chileans, North American Indians) as well as the inspection of the gait and footprints in a camp of Somalis, Soudanese and Dahomeys appears to warrant the generalization, that the divergence both in standing and in walking is less in individuals where the muscles of the front of the foot have been developed by active use of the free, unrestricted foot, than in a people who have worn shoes since early childhood. Many individuals of

these races stand with the axes of the feet parallel, the muscles of the foot and leg being sufficiently strong to enable them to dispense with the broader base afforded by divergent feet. A slight angle of divergence (which can be roughly placed at thirty degrees) is apparently not uncommon in barefooted adults when standing at ease. In barefooted young children, however, this is not the case, the parallelism of the feet appears to be the rule.

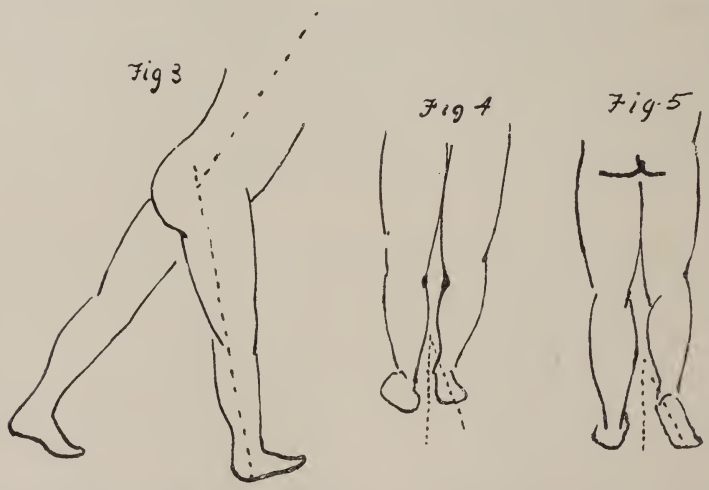

FIG. 3.—Diagram representing rapid gait, the front of the rear foot used in propulsion, as well as the weight of the trunk falling forward.

FIG. 4.—Diagram representing front view, showing angle of divergence of the rear foot.

FIG. 5.—Diagram representing rear view, showing angle of inclination of the raised sole of rear foot.

It would appear that the proper standing angle of divergence of shoe-wearing people is much less than is usually supposed to be the standard, regarding forty-five degrees in standing to be normal in strong-footed people who are properly shod, and the angle of divergence in walking as much less—not greater than thirty degrees in a leisure gait, and ten degrees in a fast walk. In young children this angle is much less. In rapidly growing children, just before the age of puberty, the angle of divergence may be great, but this is to be regarded as pathological. The divergence is chiefly due to an external rotation at the hip-joint, the thigh being advanced by the psoas and iliacus muscles, which have a mechanical advantage over the internal rotators, and would turn the limb out, unless

the counteracting muscles are active. This external rotation is increased if the rear foot is used in pushing or pulling a load. I am unable to determine to what a degree there is an outward twist at the midtarsal joint in a normal foot. Some outward eversion of the front of the foot is not uncommon in shoe-wearing people.[1]

If pedestrians are watched from behind, extreme divergence of the foot will, if present, be readily seen. In a majority of cases, however, the divergence is not marked when seen from behind. The angle, however, which the sole of the foot makes (with the vertical line) as the heel is raised from the ground at the end of each step varies with the vigor of the push and the previous divergence of the foot. If the foot has been very divergent, as the heel is raised for the final push, the heel is moved to the outside, so that the foot becomes more nearly vertical to increase the mechanical advantage of the push. Individual variations are so great that it is difficult to form a generalization as to the normal amount of this rotation of the foot, especially as in the normal gait, or straight gait; the rotating movement of the heel is not noticeable to the eye, and usually escapes the photograph focussed upon other parts of the body than the foot. In a strong, rapid gait the axis of the raised sole is vertical. Individuals with hallux valgus push in a divergent angle.

The twisting of the heel and toe are best studied in extreme cases, and are very noticeable in the run of weak-legged women with a wide angle of divergence. As the rear foot is lifted from the ground, and after the final push of the front of the foot in a leisurely gait, when the muscles are relaxed, in some instances dropping of the heel to the inside is seen. This is not seen, however, in rapid gait.

If a number of individuals are watched, looking down upon them

[1] Pedestrians have been carefully watched in Chicago at the World's Fair, in London, in New York, and Boston, as well as in the smaller towns of Holland (Delft, Middleburg, Lieuwarden), and in England, Oxford, Cambridge, and York, and the observations seem to indicate that the angle of divergence, as has already been said, was greater in London than elsewhere; but these observations were made only by inspection. The apparent angle of divergence was noted on paper as pedestrians approached, counting those who were seen at a sufficient distance for an accurate observation, and only those who walked directly toward the observer. They were also watched from the top of an omnibus.

The points in London where observations were made were at Ludgate Circus, London Bridge, Regent Circus, Trafalgar Square. Great accuracy, however, cannot be claimed for this method of inspection

from a height, it will be noticed that the axis of the shoulders is kept in walking in the same plane as the axis of the pelvis, the

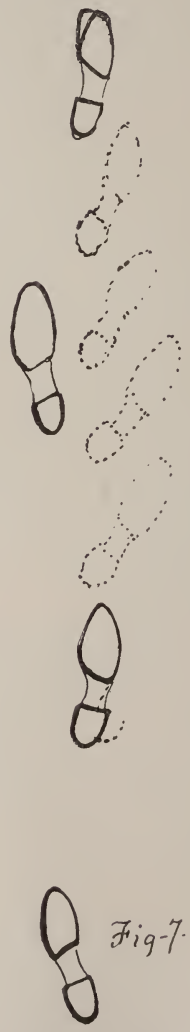

FIG. 6.—Diagram representing gait as seen from above, with square and twisting shoulders.

FIG. 7.—Diagram representing gait as seen from below, with the rotation of the moving foot.

FIG. 8.—Diagram representing footprints from a largely divergent gait in a thin layer of fresh snow.

swing of the arm giving a slight rotation forward and back of this axis. The axis of the pelvis is at right angles with the direction in which the individual is walking. There are exceptions, however. Individuals will occasionally be seen to walk with one shoulder thrust forward of the plane of the pelvis, and in fast walking it is sometimes seen that persons will change the axis of the pelvis in such a way as to lengthen the stride, swinging around the rear foot as the axis. This is done intentionally in fast walking, the individuals rotating apparently from their neck down.

An inspection of human gait from below is not practicable, except to a limited extent, when individuals who walk across a thick glass plate are watched from below. Where this is done it will be noticed that the angle of divergence is less than would be supposed. This is due to the fact that the angle of divergence in walking apparent to the eye is that as the foot spreads in the spring forward and not the angles of the feet in actual contact with the ground. A more accurate observation of this contact of the sole with the ground is taken from footprints in sand, mud, dust, and snow.

If a preparation of moulding clay or moist sand be made, and the individual stand upon the clay with one or both feet, and a cast be taken of the impression, an opportunity is afforded by which the amount of pressure exerted by the different portions of the foot can be judged. That portion of the foot transmitting the greatest pressure sinks the deepest. When the feet are together and the individual is standing still, without leaning forward, or backward, or to the side, it will be found that the weight falls chiefly upon the heel, and the heel sinks deeper than the front of the foot in the clay. If the individual leans forward the pressure comes upon the front of the foot, and if to either side the foot rotates at the medio-tarsal joint, and makes greater pressure on the outer or inner edge respectively. If a step be taken the weight comes upon the sole, and finally upon the toes. In the step the outer edge strikes first, and then the transverse arch, heads of the metatarsals, and finally the great toe itself in a full stride, the order being as follows: the os calsis, the fifth metatarsal, heads of the fifth, fourth, third, second, and first metatarsal, and finally the phalanges of the great toe. In normal feet as the weight falls upon the ball of the great toe there is a separation of the great toe from the second.

This can be seen in flexible-footed people when the foot is bare, and is demonstrated in mud and clay impressions.

The footprints in mud are of value in indicating the angle of divergence in gait. They are most readily observed if the footprints are watched on an unused pathway of frozen ground, where the sun has softened the upper surface to the depth of an inch. It will be noticed that the divergence of the feet varies considerably in gait. If a careful observation be taken it will be seen that the angle of divergence in an individual standing should not be greater than forty-five degrees. If the individual steps from this position in a leisurely gait the angle of divergence of the footprints will drop to thirty or twenty degrees. In a fast walk the divergence will drop to ten or to five degrees, or even be parallel in an active walker. In a run the foot falls to the ground with the front of the feet parallel, and in some cases there is a slight toeing-in. A similar investigation can be made on a smooth, sandy beach which the approaching waves slight moisten. In a fast walk it will be indicated that the front of the foot exerts even more pressure than the heel. If a frozen beach slightly moistened by the incoming tide be walked upon, a curious effect can be noticed. The sand will be found too hard for deep footprints, but the pressure of the step squeezes out the water and leaves the white imprints for a few seconds as the frost is forced upward by the pressure. It will be shown in this way that in fast walking the front of the foot exerts more pressure than the heel, and in slow walking the reverse is seen. Footsteps in the dust are not as instructive as those in mud, or sand, for the reason that the material is lighter, but the angle of divergence can be noted in these as well as in mud impressions.

In walking in light snow, which has freshly fallen to the depth of an inch, the imprints of the feet upon a hard, smooth surface are indicative of the angle with which the foot approaches the ground. It will be noticed that before the imprint is reached the snow is disturbed in an irregular line in the direction of motion. This is longer the less deep the snow and the greater the slant by which the heel approaches the ground, provided the individual walks naturally and does not wade through deep snow. It will be seen that the axes of the footprints form an angle with this line, indicating the amount of divergence. In the footprints in moist snow to the

depth of half a foot the turn of the front of the foot can be traced as it passes through the snow. It will be seen that the foot can be traced as it passes through the snow. It will be seen that the foot cuts the upper surface of the snow at a greater divergent angle outward than when it strikes the ground with the final push, the toe cutting in under the snow.

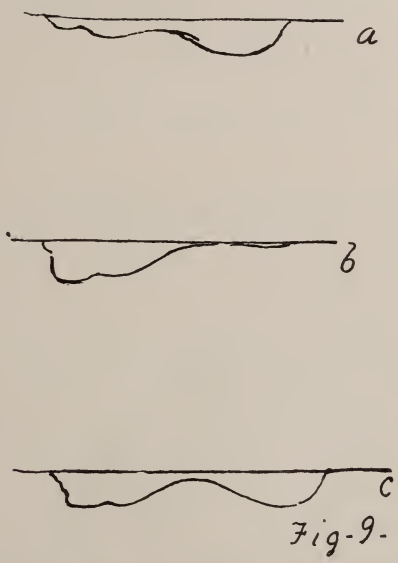

FIG. 9.—Profile of casts of foot taken from clay impressions: (*a*) standing at rest, (*b*) pressure with the front of the rear foot at the end of the step; (*c*) impression of the step, with pressure at heel and toes.

An amount of side oscillation of the trunk is seen as the weight is borne alternately on one leg or the other, varies greatly in different individuals, some swaying a great deal and others but little, influenced either by habit or muscular strength and weakness. This inclination may be more noticeable at the hip or at the ankle in different individuals. Variations may be seen in the rise and fall of the head in walking, as the weight is alternately thrown upon the heel or borne upon the front of the foot, and also according to the amount of spring at the knees. The swinging of the arms also varies with individuals and the rapidity of the gait.

No examination here is reported as to a running gait. It is,

however, well known that in running, the front of the foot and not the heel is used, and in strong runners there is no outward divergence, though in weaker runners a certain amount is noticed.

The facts alluded to in the present paper are easily observed, but frequently forgotten, and are of value to the drill-master, suggesting the question whether or not soldiers should be trained in the forward as well as in the erect gait; to the gymnastic teacher, suggesting the need of training the muscles of the front of the foot, and to the physician in seeing that the front of the foot is not crowded by the shoes. They are often overlooked by the sculptor who neglects to depict the proper angle of divergence, either in standing or walking.

This was particularly common in sculptors in the early part of this century, and may be seen in many of the statues at Westminster Abbey and at St. Paul's Cathedral. This error was never committed by the Greeks.

The proper angle of divergence is not always regarded by the drill-master. At the guard mount in London, at St. James' Palace, a few officers were noticed walking with an angle of divergence of ninety degrees. Several privates were seen standing at rest with the angle of divergence over one hundred degrees, and the file leader marched at an angle of divergence of over ninety degrees. This is not ordinarily seen in marching troops, and it is probably the result of overzeal on the part of the drill-master in a regiment not trained for campaign, but for parade service. It would be of interest to see the effect of such a step after a twenty-mile march.

This same exaggerated angle of divergence is seen in gymnastic classes. A large angle of divergence of ninety degrees is taught by many gymnastic teachers. It has its value in steadying a line, affording a broad base of support, the average individuals being weak ankled. While this is beneficial for the appearance of the class, in weak-ankled children it may be injurious.

The differences in gait are also not thoroughly borne in mind. In St. Gaudens' Shaw Monument the relations between the front foot and the rear foot are not properly preserved, as is readily seen by a comparison with an instantaneous photograph and the groups of marching men. This was undoubtedly done, however, for artistic effect, and contributes to the sense of motion in the figures, and

may be regarded as artistically correct, though physiologically faulty.

Parents are frequently anxious that children should be trained to walk with an exaggerated angle of divergence, under the impression that it is graceful and correct, as it is, the dancing master states; but the fact is that footprints in a normal, active walk are parallel, and the stronger the gait the straighter the walking.

THE HUMAN FOOT IN ART.

By E. H. BRADFORD, M.D.,
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When the sculptor Hiram Powers pointed with pride to the anatomical excellence apparent to his eyes of his Greek Slave, in contrast to the supposed anomalies in the classic masterpieces, he argued himself lacking in true artistic spirit. Correct commonplace is not preferable to what is beautiful, even though the latter may be defective in minor details. It is certainly hypercriticism to lay undue stress upon small trivialities where the whole commands admiration. No true Romanist, kissing the bronze toe of St. Peter, pauses to examine the modelling of the foot, and anyone who looks at the anatomical defects of Fra Angelico's "Coronation of the Virgin," or Botticelli's "Madonna" at the Louvre, robs himself of time which might be more enjoyably employed. And yet a study of great Homer nodding has its interest, and need not detract from our admiration or reverence.

Anyone whose attention has been called to the subject of the shape of the human foot will find it of interest to examine the feet in a collection of statues. While there is some variation in the work of different sculptors, it will be found that the types can be classed under three heads:

1. Barbaric and Egyptian type.
2. The classical type.
3. The neo-classical and modern.

The first may be considered the type of the barefooted or sandal-wearing people. The second, the barefooted or Cothurnus-wearing people, and the third, those of the races that have worn shoes. The Barbaric and Egyptian type is, as a rule, badly modelled, with the exception of some of the best of Egyptian sculptures, where

modelling in some instances is carefully done. The various statues of Rameses II., B. C. 882, the famous wooden statue of the Fourth Dynasty, B. C. 3700, are all excellent types of this class.[1] Under this head can be placed Assyrian, the works of early India, Burmese, Siamese, Chinese, and Japanese art, as well as the few crude figures from Africa, Mexico, and Alaska, and also the Archaic, Etruscan, Cyprian, and the early Greek statues.[2] This class is characterized by the lack of divergence of the axes of the feet in standing figures—that is to say, by the parallel position of the axis of the feet, by the straight inner edge of the foot, and by the

FIG. 1.

Diagram representing feet in sculpture. *a*, in Greek, Roman, and modern sculpture, copying the antique. *b*, in Egyptian sculpture. *c*, in modern pseudo-classical sculpture.

straight and uncrumpled condition of all the toes. In the Egyptian and early Greek art, where there is any attempt at careful modelling of the toes, the first toe is separated from the second, and in most instances the second toe is represented as somewhat longer than the first.[3] The second, or classical type, is best represented by the famous foot of the Hermes, supposed to have been made by Praxiteles. The characteristics are well marked. The line of the inner edge of the foot is always straight, except that there is a

[1] A mummy may be seen in the Museum of the Louvre, illustrating the care with which the straightness of the toes was preserved, each toe, including the fifth, was separately wrapped. In the British Museum, an unwrapped mummy of an Egyptian official of the XI. dynasty shows the straight first toe seen in the statues of the Egyptian type.

[2] The Greek statues on the sacred way at Branchidæ Caria, Asia Minor, sixth century B. C., show the uncrumpled fifth toe. All subsequent Greek statues show the peculiarities mentioned of the classical type.

[3] In the Museum of Northern Antiquities in Copenhagen, a round beach stone may be seen on which is cut two footprints, the inner edge is straight, the toes including first and fifth are straight. It is of unknown antiquity

slight curve below the head of the first metatarsal of the ankle. There is a separation between the first and second toe; the second, third, and fourth toes frequently diverge from the axis of the foot at an angle of at least thirty degrees, and are parallel to each other; the fifth toe is represented as short and crumpled, and is placed back of the base of the other toes; the outer edge of the foot curves behind the fifth toe to the middle of the foot. The angle of divergence of the standing feet is slight.

Fig. 2.

Diagram of feet as seen among shoe-wearing people with but little distortion. *a*, adult, first and fifth toe slightly crowded by shoes. *b*, infant with toes extended by muscular action. *c*, infant foot with toe muscles relaxed. *d*, slight crowding of the first and fifth toe, from shoe, in young child.

This type is seen in all Geek and Roman statues with but little variation, the straight direction of the first toe being universal, as well as the crumpled condition of the small toe. The curling of the small toe appears in Greek art after the sixth century B. C., and may be said to be universal since in all art influenced by Greek traditions.

The foot in modern sculpture as well as in that of the Rennaissance, is copied largely from the classic, the peculiar distortion of the small toe is universal, and in addition the fifth toe is often placed even farther back than in the best Greek type. Wherever the sculptor has endeavored to leave classic models and copy nature he has produced a curious medley of distortions. This is particularly the case in recent sculpture, where deviation of the greater toe is extremely common. Modern sculptors neglecting the classic tradition copy imperfect models. The outward divergence of the second, third, and fourth toe from the median line (copied and exaggerated from the Greek), representing the fourth toe as straight

and uncrumpled, is impossible in modern shoe-wearing models. The modern sculptor copies also the curved line on the outer side of the foot, which is seen in Greek and in Roman art, exaggerating the classic curve in a desire to present a curve of beauty.[1] Certain modern sculptors place the feet diverging from each other at a greater angle than is seen in the Egyptian and classic period.

The Greek showed such a mastery in surface anatomy, the barbaric type is so crude, and the modern type so impossible, that the first and readiest impulse would be to accept at once the foot of the Hermes of Praxiteles and show it as a model for all sculptors, as is done in many art schools; but any inquiry as to which of these types is the most correct should rest on a firmer basis than a hasty conclusion.

To form an opinion in the matter it is necessary to bear in mind the deformities of the feet caused by the footwear in the different periods referred to, and to study the human foot unaffected by shoes.

The most of importance is the common distortion of the great toe, which is known as hallux valgus, which results from the yielding of the great toe to outward pressure at its extremity. The corresponding inward distortion of the small toe from shoes is also often seen; and a crumpled and crowded condition of the toes known as hammer-toe, or curling downward of the toe, results from too short shoes or from backward pressure exerted by the front of the shoe on the extremity of the smaller toes. Another affection of the toe is extremely common in persons whose feet have been compressed by shoes, viz., a weak or powerless condition of the muscles, which prevents active muscular use at the phalangeal joints.

Some distortion of the toes is seen at a comparatively early age. The examination of the feet of a number of children indicates that in the community where shoes are worn the feet even in young children, differ in shape from the normal shape of the foot; the separation of the great toe from the second toe is lost at an early age; the fifth toe is crowded toward the fourth, and the muscular

[1] The number of modern sculptors who give to their statues hallux valgus is too great to be enumerated in a short paper. Even as careful an artistic anatomist as Gerome, in his Bellona gives this defect. The sculptors in the earlier part of the century (Thorwalsden and Canova) were more careful than the present French school, but frequently modelled the deviating great toe. This is also true of the brilliant panel of Louis XIV. and of the Renaissance de Donatello-Michael Angelo.

strength diminishes even at the age of three. Distortion of the foot in modern cities may be said to be universal, and sculptors seeking perfect models for the foot find no model with uninjured feet.

Shape of the Foot Unaffected by Shoes.

If the foot of a young infant is examined it will be seen that there is muscular power in the movement of all of the toes. The great toe can voluntarily be drawn to the inner side, and the fifth toe can be drawn to the outer side by voluntary muscular exertion; the toes can be flexed readily. The second toe is, when stretched to its full length, frequently longer than the first; the third is of the

Fig. 3.

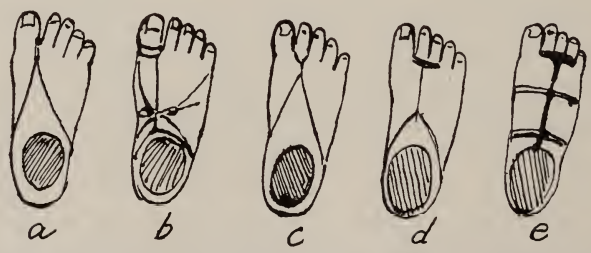


Diagram of the inter-toe thongs retaining sandals. *a*, Egyptian, Japanese, and in general use in many other countries; thong between first and second toe. *b*, Chaldean thong around first toe. *c*, Somali, around second toe. *d*, Toltec, around second and third toe. *e*, early Etruscan, around second, third, and fourth toe.

same length of the first; the fourth is somewhat shorter, and the fifth, though shorter, is but slightly so, and is readily moved, flexed, extended, as well as abducted by muscular action. None of the toes remain permanently curled, though when in a relaxed condition the terminal phalanx drops somewhat, and the smaller toes curl. A separation between the first and second toe is normal; when the muscles are active the great toe is drawn to the inner side frequently. The line of the extremity of the toes presents a gradual curve with the greatest convexity being at the tip of the second toe. There is no twist inward of the fifth or small toe. The curved line connecting the proximal end of the toes is a curve similar to that formed by the extremities of the toes. The line of the inner edge of the foot

is always straight, except when there is contraction of the muscles, when the great toe diverges to the inside.

Adult feet that have not worn shoes present shapes similar to that of infants, except that in the ordinary wear and tear of locomotion the skin is thickened, and some curling downward of the smaller toes is frequently seen, owing to the strength of the plantar muscles. For this reason the second toe is not usually seen longer than the first, as the position which it assumes is usually less straight, it being less strong; the inner edge of the foot is always straight, but in people who walk actively the great toe and its metatarsal become developed in strength and size more than is seen in infants. The foot is longer relatively to its width; the fifth toe being the weakest, is very susceptible to slight changes from lateral pressure, and where slippers have been worn or loose shoes, a slight twist of the terminal phalanx of the fifth toe is frequently seen. The widest part of the foot is at the cross-line drawn across the toes, including the fifth toe, as in the Egyptian foot.

The foot somewhat resembles that depicted in the Egyptian sculptures, except the toes are parallel, and the second, third, and fourth do not diverge from the long axis of the foot, and in a position of rest the smaller toes are more flexed than in the Egyptian statue.

An investigation of the deformities of the foot, due to footwear, leads to an inquiry into the different kinds of foot covering.

No proof is needed to show that the modern shoe distorts the foot, and an examination of any collection of shoes, as the excellent one at the Museum of the Cluny, and the remarkable historical exhibit of shoes at the Chicago World's Fair, shows that shoes of the middle ages distorted the feet nearly as much as the modern ones.[1] Distorting shoes were probably not as universally worn as at present, and were, perhaps, used chiefly by the leisure classes. But pointed-toed shoes were fashionable even among the Egyptians. In fact it may be said that as soon as man ceases to need the free use of the foot in hunting, bread-earning, marching, or locomotion, he attempts to use the shoe as a means of ornamentation, according to his own fancy, as an evidence of distinction and a

[1] This is also seen in the sculptural tomb monuments of the middle ages.

mark of freedom from base toil, like the compressed foot of the Chinese lady.

Footwear can be classified as follows: boots or shoes, where the whole of the foot is covered; slippers, where the front of the foot is covered, both holding the front by the upper, covering the dorsum of the foot, and sandals, where, an inter-toe strap connected with cross-straps holds the sole.

Although boots, shoes, and slippers vary in shape according to period and fashion, with the exception of the boots of laboring men, and jack-boots, ornamental shoes were almost always pointed, though at the period of the Thirty Years' War and at a time in the seventeenth century square-toed shoes were occasionally seen

Fig. 4.

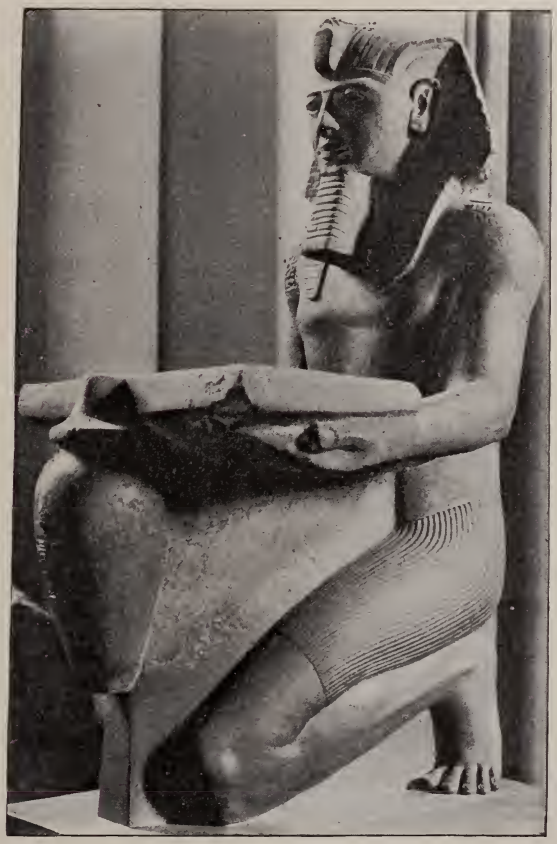
Fig. 5.

Fig. 4.—Greek sandal, with inter-toe straps, side straps compressing little toe.
Fig. 5.—Drawn from fragment of statue of Apollo, found in Phyaleia, now in British Museum, showing crowding of little toe by cross strap.

for men. Mediæval and Oriental slippers do not retain the heel, and allow the foot to slip backward without crowding the front of the foot forward. Sandals furnish a protection to the sole, and are secured to the foot by some form of thong or strap. The oldest form of sandal seen in sculpture is Assyrian, which is retained by a strap around the great toe connected with straps from the side of the sole and behind the heel. In the Egyptian sandal a thong passing between the first and second toe from the middle of the front of the sandal over the dorsum of the foot was connected with thongs from the sides of the sandal. This sandal is the most common type, and resembles the modern Japanese and the modern

Mexican and South American sandal. The ancient Toltec sandal[1] was furnished with two thongs, one passing between the first and second toe, and the other between the third and fourth. The modern Somalis wear a sandal with a thong split so as to admit the second toe, leaving the other toes free.

Fig. 6.



Egyptian statue, British Museum, showing straightness of toes.

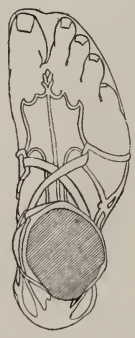
The early Etruscans apparently wore a sandal with cross-straps, the front one passing from the sole of the sandal between the first

[1] Collection at the Peabody Museum, Harvard University.

and second toes over the second, third, and fourth toe, where it is secured to the sandal, leaving the first and fifth toe free, the other toes being secured under a strap.[1]

In all these forms of sandals no pressure is exerted upon the small toe, but in a form of sandal with a front, a cross-strap, seen in the Orient, for the insertion of the front of the whole foot, a certain amount of pressure is exerted on the side of the little toe, as in a slipper. This strap is, however, as loose as the cross-strap in snow-shoes.

Fig. 7.



Foot from the Hermes of Praxiteles, without the cross- or interior-strap, but showing the distortion of the little toe.

In the Greek sandal, however, a cross-strap or straps were apparently connected by lacings to be tightened in such a way as to be more firmly held to the foot. The forms varied greatly. In most a single inter-toe strap existed, to be caught in the cross-straps. In some later sandals, however, the inter-toe strap was omitted, a reminder surviving conventionalized in the shape of the sole, which preserved a slight depression at the front of the sole between the first and second toe. The Greek and Roman sandal gave freedom to all the toes, except the little toe, which was crowded by the cross-strap, as well as by oblique straps which in some form of sandals passed backward from the sides of the front of the sandal to the instep, raising and crowding the little toe and the side of the first metatarsal. When this was snugly laced an inter-toe thong became

[1] This is seen in the rare terra cotta tomb effigy of early Etruscan period (uninfluenced by Greek art) showing a sandal differing entirely from any seen elsewhere.

unnecessary, as the pressure on the little toe and the top of the foot prevented the foot from slipping forward. This sandal can be easily imagined, if we suppose a bicycle shoe with the tip removed, leaving all the toes except the small toe free.

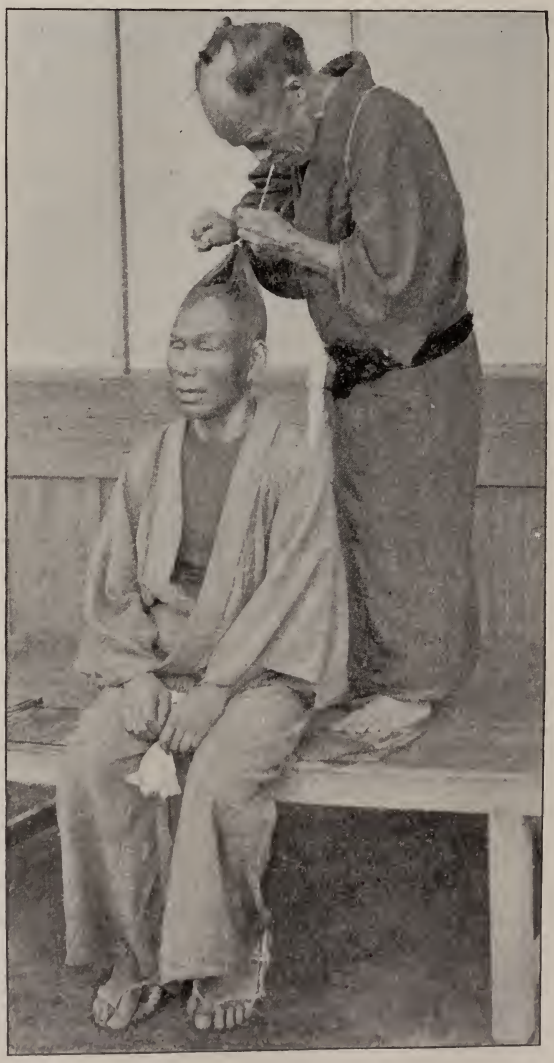
A sandal of this sort was perhaps not developed in the early period of Greek history, but judging from sculpture, the Cothurnus of the late Greek and Roman period[1] probably differed but slightly from that of the classical period. Besides the sandal, the ancients at times wore a loose covering like a moccasin, which did not affect the shape of the foot.

Footwear of this sort would develop the shape in the foot seen in the Hermes of Praxiteles, crowding the small toe, giving the full length of the fourth, third, and second toe from the free and strong development of these toes, allowing the straight first toe and the inward curve on the inner edge of the first metatarsal at its proximal end by the pressure of the oblique strap, and also the outward curve on the outer edge of the foot, as the chief pressure of the strap came upon the little toe and not on the metatarsal, whilst the ankle behind the metatarsal was bound. The inter-toe strap accentuated the separation of the first and second toe and the deviation from the axis of the foot of the smaller toes. This slightly distorted foot was seen in the models studied by the Greek masters, and gave the type. The dominating influence of Greek art explains the fact that the shape of the foot has been copied

[1] An examination of Greek and Roman footwear as seen in sculpture is made difficult from the fact that in many instances the sandal is conventionalized and only indicated, A great variety is also found from the moccasin-like foot covering shown in the fragments of the Parthenon and the elaborate sandals of Roman emperors. A sandal is to be seen in the late Greek statue of Ariadne, found in the Roma Vecchia, and now in the British Museum, showing side loops for a cross-thong across the base of the toes, and crowding the fifth-toe, leaving the thong to the imagination. The sandal in the statue of Jason at the Louvre shows the indentation in the sole opposite the space between the first and second toe, where a thong would be attached, but not only is there no inter toe-thong, but the sandal is apparently to be kept in place without one, by the side leathers laced over the instep. A peculiar sandal is seen in a group of the Roman period, in the Louvre, called Mars and Venus, in which a depression is delineated, allowing the longer toes to drop to a lower level, The Roman sandals in the Museum of the Cluny, found near the Rhine, and at the Museum in Munich, show a straight inner edge which would have satisfied a North American Indian, and the sandals depicted in the Greek votive tablet in the British Museum would have been acceptable to a modern Japanese, The bronze statuettes of the youthful Bacchus, in the Payne King collection in the British Museum, show the side compression of the inner edge of the foot and of the little toe, without a cross toe-strap, while the statue of Hadrian, also in the British Museum, the Diana Chasseresse, the seated Philosopher, of the Louvre, as well as many other statues, indicate the compression by lacing including the cross toe-strap.

since then by all sculptors who have accepted Greek art as its fountain-source. In the Rennaisance, where models were used by the great masters in painting and sculpture, the deformity of the

Fig. 8.



Japanese foot, showing normally straight toes.

great toe following the use of the shoes which crowded the first toe outward is commonly depicted, and in sculpture is occasionally seen. In modern French sculpture, among the realists this defect, the well-known hallux valgus of the model is added to the classic

FIG. 9.

Painting by Sir Joshua Reynolds, showing distortion of great and little toe.

defect, namely, an exaggerated difference between the fourth and fifth toe, and exaggerated rounding of the outer edge of the foot. Modern sculptors frequently also give a greater angle of divergence to the axes of the feet in the standing figure than is seen in

classical statues, and much greater than in Egyptian or barbaric figures. In this, too, the modern artists are copying defective models to the detriment of their art.

It can, with a certain amount of justice, be argued that when a conventional use has been sanctioned for a long period of acceptance, without violating the laws of beauty, it has justified its existence by a right of pre-emption, and that it is hypercritical to object to it. The argument hardly applies to a deformity, and would at once seem inadmissible, if urged by a Chinese artist in defense of the beauty of the golden lilies, as Chinese poetic fancy terms the deformed feet of Chinese ladies. The deformities here mentioned differ in degree, but not in kind, from that accepted by usage in China; they are also distortions of nature. There is a healthy tendency in modern art to revolt against what seems classic convention, and to copy nature, but to do this the artist needs thorough knowledge to enable him to escape presenting as a standard the defect observed in his own experience. The taint of the corsetted and high-heeled, weak-ankled grisette injures every modern art exhibition, even when the ideal is attempted. The sculptor who moulds "immortal forms" should not perpetuate deformity.[1] There should be no Zolaism in sculpture.

Few, even among the artists, realize how common it is to find defects immortalized in masterpieces. The wry-neck of Alexander the Great may be allowed in a portrait statue, but it would be an error to give the statues of all heroic generals twisted heads. Crumple-footed divinities and out-toed demigods and demigoddesses and weak-ankled national heroes cannot but offend the fastidious when seen in lasting marble and monumental bronze.

The normal foot resembles a combination of the Greek and Egyptian sculptural foot. It is straight on the inner edge, with-

[1] The defects in drawing of human feet seen in pictures are not referred to here as fully as could be done in a longer paper. Less care is given to modelling in pictures than in sculpture. In brief, it may be said that the defects mentioned are more common in the paintings, even of the old masters, than in sculpture—the crowded fifth toe is universal, and a hallux valgus can be found in the works of all the great old masters. In the gallery at Amsterdam a picture by Henry Goltzius, A.D. 1600, depicts a dying Adonis with the feet set forward in the foreground, and displaying a double hallux valgus of an aggravated type. Rubens has never thrust his errors so directly upon the spectator, but his faults in this particular are fully as grievous, as is shown in his book of design in the Musee Plantin, Antwerp, and in almost all his paintings. Michael Angelo, Titian, Tintosetto, Raphael, all show both the crowded little toe and frequently hallux valgus.

out the slight curve along the base of the first metatarsal; the fifth toe is parallel to the others, and is not twisted or crumpled, and is not placed far back of the lines of the other toes, the outer edge is but slightly curved. The toes, however, are flexible, and do not project stiffly as in an Egyptian statue, but are when at rest slightly flexed, especially the smaller toe. It may be said that a foot of this sort is not as graceful as that presented to us by the Greek artist. This contention lacks strength, however, in the mind of anyone who has seen the flexible feet not disturbed by toil or crumpled by footwear. It is certainly the province of the artist to furnish us with beauty as he sees it, but he must find it within the lines of truth. It is as true now as in Shakespeare's time, that

> Above the art we add to nature
> Is the art which nature gives.

ROUND SHOULDERS.

By E. H. BRADFORD, M.D.,
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The condition of round shoulders has been classed as a form of kyphosis, and this is undoubtedly a correct classification, but certain features deserve especial consideration. They are frequently seen in growing girls and boys, and occasionally in weak adults. The scapulæ drops forward, the posterior edges projecting behind. The shoulders seen from in front project with marked depression to the inner side, as if the clavicles were curved inward to an unusual degree. The neck is thrown forward, and the abdomen is protuberant, owing to an unusual hollowing in of the small of the back. The spine may be flexible, but in many instances the upper part is stiff.

If the individual attempts to bring the uplifted arms to a vertical line, it will be seen that the hollowing of the back is increased by the individual, who thrusts the abdomen forward while stretching the arms straight above the head.

If a gymnastic class of growing children be watched while performing exercises this will be found to be quite noticeable in many instances. Where the arms are raised this is only done by an exaggerated hollowing in of the back.

This condition can be more carefully examined if the child is placed flat, face downward upon a hard surface like a board or table, with the arms at right angles with the trunk. If the hand of the examiner is placed upon the back between the shoulders, and with the other hand, the elbow raised, it will be found that the arm can be pressed above the plane of the trunk. If, however, the arms are brought to the side of the head in the axis of the trunk, it will be found that in many instances they cannot be raised to the

plane of the trunk. Frequently the arms cannot be brought to the sides of the head without raising the shoulders from the board on which the patient is lying. In other words, the play in the shoulder-joint is limited in certain directions, and in some instances the back-play of the raised arm is seriously impaired. In some instances this lack of free movement in certain directions will be found greater in one arm than in the other, giving an inclination to twist the

FIG. 1. FIG. 2. FIG. 3.

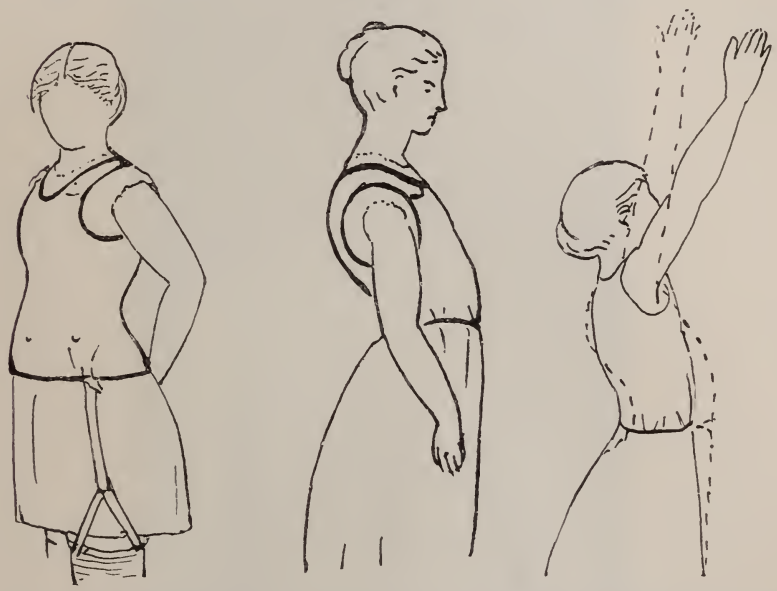

FIG. 1.—Diagram showing child's waist, to which a stocking supporter is attached.
FIG. 2.—Attitude of child; projecting abdomen, hollowing in the back and bending neck forward. The skirts, buttoned on the waist, exert a forward pull upon the shoulders.
FIG. 3.—In raising the arms the back is bent forward in the lower dorsal region

upper part of the body. Usually, however, the defect is bilateral. This affection is not due to a contraction of the pectoral muscles, which would manifest itself when the arms were at right angles with the trunk, but to a shortened condition of the ligaments, and possibly to an alteration in the joint surface in a certain direction.

In seeking a cause for this affection some impediment to the upward movement of the arms suggests itself, and the effect of clothing needs to be examined.

Both for convenience, and owing to an exaggerated fear of injury to the pelvis, as well as for the purpose of arranging the clothes tastefully, it is the custom in dressing children to throw the weight of the garments upon the shoulders, fastening the skirt and, in

Fig. 4.

Photograph showing depression in the outline of the shoulder, caused by shoulder-straps of waist.

many instances, stockings to the waist. These waists are made of various shapes, but usually have a narrow shoulder-strap which presses upon the upper portion of the trapezius and upon the clavicles to the inner side of the head of the humerus. They may also

exert pressure if pulled downward upon the upper portion of the sternum. Where, as is usually the case, the skirts are buttoned to the front of this waist, a considerable drag is exerted, and in this way pressure falls upon the trapezius and the sternum, the head is thrown forward, the shoulders drop forward, and the chest is contracted. The amount of the weight from the clothing is not inconsiderable, making the erect position less easily borne, the child

Fig. 5.

Front view, showing contraction of the chest from forward drooping of the shoulders.

naturally seeking the position of greatest comfort. Where stocking supporters are added the downward drag may become more than would be supposed. Where a faulty position is assumed a greater part of the day the soft tissues adapt themselves, and a faulty attitude becomes habitual, the ligaments adapting themselves to such a shape. It is not probable that any pressure is exerted which would cause a distortion of the clavicles, as these are particularly strong bones, though this may occur in rhachitic children. Fortunately, however, in rhachitic children when rickets is most prevalent, the weight of the garments is not great. Some-

what the same effect may result from the use of suspenders, or from the straps of an antero-posterior support in Pott's disease. Suspenders, fortunately, are not worn ordinarily until the figure assumes its shape.

The prevention of this deformity is more important than the cure, which must necessarily involve a long-continued treatment, designed to stretch the ligaments and strengthen the muscles. It is important to bear in mind that the clothing should be so arranged

FIG. 6.

Side view, showing forward drooping of shoulder from weakness of trapezius.

that none of the weight of the skirt or underwear should drag upon the front of the waist. As far as possible, where any weight is thrown upon the shoulders, it should be a force that would pull the shoulders back. The waist should be so constructed as to make no pressure upon the sternum. The shoulder-straps should not bear upon the middle of a clavicle, but upon the acromion. In young growing children the most of the weight of the underwear should, as far as possible, be borne upon the hips, lessening the load upon the shoulders.

LAXITY OF THE LIGAMENTS WITH CONGENITAL HIP LUXATION.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

The causes of congenital dislocation of the head of the femur usually given are trauma at or before birth and anomalies of development of the parts forming the hip-joint, which may be related to faulty positions of the fœtal limbs, to deficiency of the amniotic fluid, to precocious union of the component bones of the acetabulum, or to imperfect or retarded ossification. From the evidence at hand it seems clear that there are several distinct groups of cases in each of which the causation is different, and we must look to future investigation to define more accurately the limits of each group and the proportion of cases which it contains. This is also a matter of some practical interest, since the method of bloodless replacement now coming into prominence is more likely to succeed in those cases in which the acetabular cup is still somewhat capacious. This would be the case in the traumatic cases, and in many of those in which the defect occurred late in fœtal life, and particularly where the primary fault was outside the bony parts, or at least where the malposition had not existed too long. The examination of a certain adult pelvis exhibiting bilateral congenital luxation of the hip convinced me that the cause would sometimes be found in a deficient development of the whole pelvis; in this instance, beside the marked shallowness and irregularity of the acetabulum and the flattening of the femoral heads, the entire pelvis was very light, and some parts, such as the central portion of the ilia, were of eggshell thinness, and the arches of the sacral vertebræ were incomplete, though there was no projecting tumor. This specimen was to me convincing evidence of a widespread de-

fect in the bony development of this individual. My attention was still further drawn to the important *rôle* played in certain cases by a widespread defect, of which the anomaly at the hip-joint was but one manifestation, through a paper by Prof. Julius Wolff, who described[1] the case of a nine-year-old girl with double congenital hip luxation of the ordinary type, but presenting other features of special interest. There was fixed dislocation of the left tibia forward, a similar dislocation of the right knee, which could be produced and replaced at the will of the patient, and marked laxity of nearly all the joints of the body, in several of which luxations or subluxations existed. It is noted that some of the fingers and toes could be hyperextended till in contact with the dorsum of the hand or foot, and the others nearly as far. Prof. Wolff considers the ligamentous relaxation congenital, and calls attention to the close relation between it and the congenital displacements.

Since reading this paper I have been in the habit of observing the range of motion in the various joints in the cases of hip luxation which have presented themselves for examination, with the view of ascertaining whether abnormal laxity of ligaments in the non-luxated joints was of frequent occurrence. In the great majority of the cases examined nothing unusual was found; but in two cases seen in Dr. Townsend's clinic at the Hospital for the Ruptured and Crippled very distinct evidence of abnormal ligamentous laxity was present.

Case I.—Girl, aged eight years, seen September, 1896; congenital dislocation of the left hip; R. A., 26½; L. A., 24½; trochanter elevated; joint not firm; walks with a decided limp. The knees, elbows, fingers, and toes are markedly loose and hyperextensible, permitting an abnormally wide range of motion; the other joints of the limbs are also somewhat loose, but less noticeably so.

Case II.—Girl, aged four years, seen October, 1896; double congenital luxation of the hips, of the ordinary type. There was great laxity of the ligamentous structures of the ankles, wrists, fingers, and toes. The fingers could easily be hyperextended until in contact with the arm, and the toes nearly to the dorsum of the foot. The patient's brother, six years old, is said to have loose

[1] Zeitschrift für orthopädische Chirurgie, vol. ii. No. 1.

joints similar to those of the patient, and a rather peculiar gait. The remaining two children of the family show no abnormal laxity of ligamentous structures and are otherwise free from anomalies. Dr. George R. Elliott has recently told me of a somewhat similar case in his practice.

In Cases I. and II. the increased mobility at the joints named was very marked, but no dislocation was detected except at the hip. The causes of joint laxity usually recognized are excessive traction, especially in a paretic limb, the pressure of malpositions or displacements, and the distention of joint effusions. To these, it would seem, we must add a congenital tenuity, elongation, or defect of the ligamentous structure of such degree that dislocations readily, perhaps inevitably, follow. We are thus obliged to consider this condition as an essential factor in the production of congenital luxations in a certain number of cases.

DISCUSSION.

Dr. Ketch asked if Dr. Taylor had not observed the same condition in rhachitic joints, particularly a lateral mobility, without a special tendency to dislocation.

Dr. Taylor replied that he had paid no special attention to this point.

CONGENITAL ABSENCE OF THE RADIUS.

By HENRY LING TAYLOR, M.D.,
NEW YORK.

In September, 1895, there came into Dr. Townsend's clinic at the Hospital for the Ruptured and Crippled a very delicate-looking female baby, aged five weeks, for the treatment of congenital club-hands of a severe type. The elbows were held flexed at about a right angle, the forearms semi-pronated, and the hands turned at the wrists so far toward the radial side that the thumbs came to lie in contact with the anterior aspect of the arms. The shoulders and elbows were movable, but the deformity at the wrist could only be partially corrected by manual force, the muscles, tendons, and tissues on the radial side of the forearm being very much shortened. The most careful examination failed to reveal any rudiment of a radius on either side, and this was confirmed by skiagraphs taken at the age of fifteen months. The ulnæ were shorter than normal, and bowed toward the radial side. This child was the fourth, the others being healthy and well formed. A fifth child, born since this paper was written, is also said to be free from defect. No cases of congenital deformity were known in the family. The labor had been easy. The head was rather large and square, the shoulders sloping, and the forearms were very short; but the hands, thumbs, and fingers were well formed, and no other congenital anomaly was detected in any part of the body, except a peculiar condition of the left knee-joint, which exhibited such laxity of the external lateral ligament that the leg had a free lateral movement inward from 165° to 110° (adduction), with some inversion and a strong tendency to subluxation of the head of the tibia backward. The patella was well developed, and palpation and the x-ray failed to reveal any noticeable defect in the bony parts.

Congenital absence of the radius.

This abnormal mobility seemed to be due to a natural defect or intrauterine stretching of the external lateral ligament, and probably other ligaments of the knee.

The case was therefore diagnosticated as club-hands due to congenital absence of the radii, with a peculiar congenital deformity and weakness of the left knee.

In considering the treatment of this case it seemed wise to wait until the child was older and the parts larger before undertaking any radical operation, and it also appeared to the writer that any operative procedure that might later be undertaken would have much greater chance of success if the deformity were corrected so far as possible and the contracted tissues on the radial side stretched by splinting the hands and forearms. This was done by small, padded gutter splints of gutta-percha molded to the parts, applied to the radial side, and kept in place by bandaging. A posterior molded gutter splint of gutta-percha was also applied to the knee, with a pad behind the head of the tibia to keep it forward. The child was sickly and suffered from malassimilation, and for a time with eczema of the face and head, and at first excoriations under the splint were easily produced, but by perseverance and repeated adjustments the splints were kept applied most of the time from the start, and the skiagraphs, taken with splints applied at fifteen months, show the hands still dislocated to the radial side, but in greatly improved position. They also show the ulna somewhat bowed and thickened at the proximal end. The picture of the two arms is almost identical. One is shown in the figure. The resistant tissues on the radial side of the arm were already much less contracted.

Re-examination, April 28, 1897, the child being twenty and one-half months old, showed the following condition: General health and condition fair. Flesh very flabby; head square; occipito-frontal circumference, 17¾ inches. Anterior fontanelles still open; first tooth at eight months; eleven teeth now erupted. Body large; abdomen big, 20½. Length of body, 28 inches; chest, 18. Says papa and mamma only, but seems intelligent; does not walk or stand. Right arm and left arm, 10¼. Shoulders sloping. Length of clavicles, 2½ inches. Length of humeri, 3½ inches. Length of ulnæ, 2½ inches.

On the ulnar aspect of the right forearm, about one-half inch above the end of the ulna, was a small but very distinct, scar-like mark. There was a still smaller one near the middle of the outer aspect of the arm, and one back of the shoulder. On the left side scar-like marks were distinctly present in the two latter positions, but could not be certainly made out near the wrist. There was a faint dimple and discoloration of the skin near the end of the ulna on both sides.

The motion at the shoulder is free; at elbow angle greatest extension is about 165°. Wrist movements free, except ulnar flexion—adduction. The left knee has somewhat improved, the motion inward now being 180° to 130°.

A second case seen at the clinic in March, 1896, is worth noting. This was a fairly developed and fairly healthy-looking female child, two weeks old, born with extreme right club-hand to radial side. There was no club-hand on left side, but both thumbs with their metacarpal bones were absent. So far as could be ascertained by palpation there was no radius on the right side. There was no other deformity, neither was any deformity known in the family. The patient was the thirteenth child, all the others having been free from defect. This child disappeared from observation, and on trying to trace it last winter I found that it had died.

The literature of congenital absence of the radius up to 1890 has been well epitomized by Dr. Oskar Schmid,[1] who tabulates forty-eight cases. There were forty-five cases of total absence, of which twenty-one were bilateral, twenty-three unilateral (twelve right, eleven left), and one unclassified. There were eight cases of partial absence, and in five of these there was total absence in the other arm; in three the other arm was normal. Twenty-one cases were fœtuses, twelve were stillborn, six died between five and sixteen weeks, and eight cases were still living at the time of publication at an age of from one to twenty-five years. In the eight cases of partial absence of the radius the distal portion was absent in six and the proximal in two. In all the cases, except the last two, the carpus with the hand was displaced to the radial side. With total absence the first digit (thumb and its metacarpal

[1] Zeitschrift für orthopädische Chirurgie, vol. ii. No. 1.

bone) was absent thirty-five times, rudimentary five times, and only twice fully developed. With partial absence the first digit was absent four times, rudimentary once, and fully developed three times. Cases with two, three, and four absent digits have been reported, and the digits fall away in order from the radial side, the fifth digit being the most persistent. Two of the complete cases and two of the partial show perfectly developed hands. In all the dissected cases but two, one or more carpal bones articulating with the first digit and radius were lacking. The ulna was usually thickened at its upper extremity, shortened, and bent. The mobility of all the joints of the upper extremity, especially the elbow and wrist, was less than normal. The affected extremity was usually less developed and its muscles weaker than normal; there were suppression, imperfect development, and anomalies of position in the muscles, vessels, nerves, and other structures on the radial side of the forearm. In the large majority of cases there were congenital anomalies in the arm of the opposite side and in other parts of the body. There were only four cases with no defect other than that connected with the absent radius. In very few cases was there any history of congenital malformations in the family, or any circumstance which would throw light on the etiology.

A number of cases confirming the foregoing picture have been reported since 1890, of which I will mention:

1. Kirmisson and Longuet.

a. Male infant, died at nine months. Autopsy: Bilateral club-hands; first digits stunted; radii imperfectly developed, especially at distal extremity; small, scar-like depression over distal end of ulna.—*Revue d'Orthopédie*, March, 1892.

b. Female infant, died of broncho-pneumonia at thirteen months. Autopsy: Right club-hand, absent radius, scaphoid, semilunar, trapezius, and first digit. Right ulna short and curved; skin dimple over styloid process. Left upper and both lower extremities normal.—*Revue d'Orthopédie*, January, 1893.

2. R. H. Sayre. Boy, nine years old; right congenital club-hand; lateral curvature of spine; right congenital pes equino-varus; right radius, first digit, and several carpal bones absent; ulna curved.—Trans. Amer. Orthopedic Assoc., 1894, vol. vi.

3. S. L. McCurdy. Female infant, died of tuberculosis at ten months(?); bilateral congenital club-hands with absence of both radii. No other deformity.—TRANS. AMER. ORTHOPEDIC ASSOCIATION, vol. viii. p. 8.

4. Dr. C. E. Thomson. Girl, aged seventeen years; bilateral club-hands; absence of radii; bowing of ulna. No other deformity.—TRANS. AMER. ORTHOPEDIC ASSOCIATION, 1896, vol. ix. p. 65.

The typical picture, then, is a fœtus, or a stillborn or feeble infant, with absence of the radius, bilateral or unilateral, club-hand from dislocation of the carpus to the radial side, with rudimentary development or absence of one or more radial digits, and one or more radial carpal bones, shortening, bending, and thickening of the ulna, and certain congenital anomalies of the arm and of other parts of the body. There is in most cases no history of congenital deformity in the family. To these it seems likely that congenital pseudo-cicatrices over some of the prominent bony points of the arm, and particularly over the end of the ulna and acromion, will be found if searched for. There may be variations in all or nearly all the details above enumerated. In only two cases of complete absence analyzed by Schmid were the thumbs normally developed, but this was the case in McCurdy's, Thomson's, and my first. Sayre's and Thomson's are exceptional in having reached the ages of nine and seventeen years.

Two theories of the etiology of this affection have lately been prominently advocated. The first assimilates it to the archipterygeal or primitive fin theory of Gegenbaur, according to which the arm consists of a stem and four rays, the first ray comprising the radius, scaphoid, trapezium, and first metacarpal, with its digit. According to this theory, the bone defect is always a suppression in regular order of one or more rays, and central nervous influence is rather blindly invoked as a causative factor. As those cases with a well-developed thumb do not agree with this theory, its advocates assume that these are not cases of absent radius, properly speaking, but cases of fusion of the radius with the ulna.

The second theory ascribes the anomalies to a mechanical cause, namely, the pressure of a too tight amnion, with deficient fluid at the time of development of the arms, namely, about the fifth week. Though the cause of this assumed constriction is imperfectly known,

the theory has some strong points in its favor, and particularly those afforded by the analogous condition, absence of the fibula. The tibia is the homologue of the radius, but the fibula is analogous in position, and, like the radius, much more exposed to pressure from the outside. As a matter of fact, absence of the radius and fibula, though rare, is very much more common than absence of the ulna and tibia. In cases of absent fibula the fifth digit is usually lacking, and the tibia shortened and bent; but, what is still more interesting, dimples, furrows, or scar-like marks are nearly always found near the projecting angle of the tibia, and there is good reason to believe that these were caused by the separation of amniotic adhesions. In several cases of absent fibula it was noted that the waters were very scanty at the labor.

The significance of the marks observed in Kirmisson's cases and my first will now be apparent.

The operations proposed for the rectification of the deformity are:

a. Section of the contracted tissues on the radial side of the arm.

b. Simple or cuneiform osteotomy of the ulna followed by overcorrection.

c. Excision of one or more bones of the carpus and the insertion of the end of the ulna into the cavity. (R. H. Sayre.)

d. Splitting of the distal end of the ulna and fixing the carpus in the gap. (Bardenheuer.)

e. Cutting off the end of the ulna and fixing the proximal end to the radial side of the carpus. (McCurdy.)

It is the hope of the writer that the indications for each method may be brought out in the discussion. It seems, also, that insufficient emphasis has been laid on preliminary stretching with properly adjusted splints. Several operators speak of the difficulty or impossibility of bringing the hand in position even after sections of soft parts and bones, and this could in most cases have been obviated by preparatory stretching. Another point to be brought out in the discussion is the proper age to operate.

ON THE MECHANICAL TREATMENT OF UNUNITED FRACTURE OF THE NECK OF THE FEMUR WITH TRACTION APPARATUS, PRODUCING ABDUCTION OF THE THIGH AND DIRECT LATERAL PRESSURE OVER THE TROCHANTER MAJOR.

By NEWTON M. SHAFFER, M.D.,
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Case I.—On December 16, 1885, I was asked to examine Mr. M. P. G., aged forty-two years, who gave the following history:

On October 1, 1885, Mr. G. was thrown from his horse and sustained an intracapsular fracture of the neck of the femur on the left side. The accident occurred a few miles from New York, and the patient was at once brought to his city residence, where he was treated by the "Buck's extension" method under the most favorable conditions by one of our best-known surgeons. At the end of ten weeks an examination proved that the fracture had failed to unite, and the patient was given to understand that he must expect to be lame all his life, the alternative of a surgical operation being positively declined by him. I had known the patient previous to the accident, having prescribed for a weak knee of the right leg. He sent for me to ask if anything could be done from an orthopedic standpoint. At first I was inclined to advise the surgical procedure, but the patient declined to entertain any proposition of this nature. He was possessed of an indomitable will, and said he would undertake anything which I suggested which would give a chance for recovery or even relief.

Three cases of ununited fracture of the shaft of the femur—two at about the middle of the femur, and one just below the trochanter minor—had come under my observation and treatment, and had

been successfully treated by the long-traction (hip) splint and an accurately fitted coaptation splint; and two cases of unilateral congenital dislocation of the hip-joint had been very much benefited by the same method of treatment, the coaptation splint in the latter cases being a firm belt, properly padded, passing around the pelvis, making a direct lateral pressure over the trochanter major. In all these cases the limb had been restored to approximately its normal length by the traction splint, and this length had been maintained for a sufficiently long period. Complete bony union had resulted in the fracture cases, and an improved position, with a firm artificial joint, had resulted in the dislocation cases. I had long felt that the treatment of recent fracture of the neck of the femur lacked especially a sufficient means to control the fragments and keep them in apposition; but no opportunity to treat any recent cases of this nature had presented itself in my practice.

I explained to Mr. G. the method by which we might hope to secure a union of the fracture, based upon the results just related; but I also informed him that it would be an experiment, and that I would not undertake it unless the plan was approved by a formal consultation. The late Dr. Henry B. Sands, who had been familiar with my ununited fracture and congenital dislocation cases, was consulted, and after examining Mr. G. he gave the proposed treatment his fullest sanction.

The thigh and leg were in the characteristic position of fracture of the neck. There had apparently been no attempt at union. A flail-like movement was present at the point of fracture, and the limb was two and three-quarter inches shorter than its mate. The patient was in excellent health and spirits, and the experimental treatment was commenced under favorable auspices.

On Christmas Day, 1885, the long, straight Taylor hip-splint was applied. This was, almost to a day, twelve weeks after the original injury. In four days the limbs were of equal length. A belt about three and one-half inches wide, made of surcingle material, such as is used by saddlers, was now passed around the pelvis, a crescentic-shaped horse-hair pad being placed over the trochanter major. This belt was firmly buckled at the opposite side of the pelvis. The limb was now placed in abduction at an angle of about 20°, the origin of the adductor muscles being used as a fixed

point to throw the distal toward the proximal fragment. A lever was thus created where the fulcrum (the origin of the adductors) was between the power (the lower end of the limb) and the resistance (the seat of the fracture). The entire limb was now placed on an inclined plane at an angle of about 135°.

I felt very sure, as I studied the conditions from day to day, that the traction maintained the length of the leg and that the abduction of the thigh approximated the fragments; but I did not feel certain that my "surcingle" was making a sufficient lateral pressure. I felt that the "surcingle" was the weak point of my apparatus. I then further increased the lateral pressure by passing a tourniquet over the padded surcingle, and after that I had at hand the means of absolutely controlling the lateral pressure. When the patient was moved in bed for any purpose, or when the traction was modified in any way, or when the perineal pads were loosened, the tourniquet pressure was carried up to the point of toleration. At other times the tourniquet pressure was modified. This pressure did not give rise to any trouble, nor did it seriously interfere with the circulation.

Among the objections urged by some of my critics and friends in Mr. G.'s case was one which especially appealed to me. The knee-joint had already been immobilized about twelve weeks, and it was justly feared if the fixation of this joint was prolonged during a further period of perhaps months that it might become seriously damaged. Before applying the straight traction splint I had therefore carefully measured the patient for an apparatus which combines all the advantages of the straight traction splint with an arrangement at the knee by which motion could be secured at this articulation whenever necessary.

On January 3, 1886, I applied this splint. I will briefly describe it.[1] It has the conventional pelvic band, which is strong and solid, with the ordinary perineal pads. It has an abduction screw by which the shaft of the apparatus can be placed in any desired lateral position, and it has a mechanism at the knee by which motion

[1] Further experience proves that this complicated form of apparatus is not necessary. A simple, long traction hip-splint based upon the Davis-Taylor principle, and which can be obtained from any instrument maker, answers every indication in both acute and chronic cases.

can be made whenever desired at this joint. It also has two traction rods, one at the thigh part and one at the leg part, each with separate adhesive-plaster attachments. By this arrangement traction can be made upon the thigh, while that at the leg is removed or modified. During the treatment, after the first two weeks, the patient was drawn down to the foot of the bed until the knee-joint was opposite this point. The leg traction was then modified and the thigh traction increased. We were thus able to flex the leg without disturbing the thigh traction. While this was being executed the tourniquet pressure was greatly increased. The knee was thus "exercised" every second day without trouble and without pain and without any detriment to the fracture.

On January 19, 1886, Mr. G. was successfully removed to Lakewood, N. J. On January 28th he was placed on his feet with the use of crutches, a high shoe (two inches) being placed under the foot of the sound limb. He commenced at this time to walk on crutches, until he daily walked half a mile or more out of doors. He was allowed to stand up or to walk at will, but he was never permitted to sit down or to try to sit down. His health remained good in every way, and on April 11th, about four months after treatment was commenced, Dr. Sands saw the patient with me, and found a solid bony union. It was deemed best, however, not to discontinue the protection of the traction apparatus. A modified (perineal support) treatment was kept up until June 5th, when he was discharged cured.

At the final examination the limb was found to be three-quarters of an inch shorter than its mate. The patient could walk well. He did not need a high sole to compensate for the difference in the length of his legs. All the motions of the hip were somewhat modified. Flexion was almost complete; abduction and adduction were slightly less than normal; extension of the thigh was resisted somewhat, while rotation in and rotation out were somewhat limited.

I saw Mr. G. in London last summer. No one would notice that he had anything more than a peculiar gait. He is not lame. He walks long distances, hunts and rides on horseback, plays tennis, etc., as well and as actively as if his hip had never been injured.

CASE II.—On October 9, 1889, I saw Miss X., aged forty years. Eighteen months previously she had received an injury in Europe, and had sustained a fracture of the neck of the femur. The limb was three-quarters of an inch shorter than its mate, and a distinct "telescoping" could be demonstrated as well as a distinct crepitus at the point of fracture. In consultation with Dr. Charles McBurney, on October 15th, the diagnosis of intracapsular fracture was confirmed. I submitted to Dr. McBurney a plan of treatment similar to that which had proved successful in Mr. G.'s case, and he expressed himself as fully approving the effort. The patient was informed that the issue would be doubtful, and that the length of time which had elapsed since the injury made the treatment an experiment. After due deliberation she decided to make the attempt.

It was decided to pursue the treatment for three months, and then, if there was no evidence of union, the effort was to be abandoned. Accordingly, on October 30th the long traction splint was applied with the abduction screw, the surcingle, and the tourniquet, and the same treatment outlined in the previous case was very carefully carried out. The patient was seen by Dr. McBurney on November 15th and again on December 6th. On February 1, 1890, three months after the first application of the traction splint, the apparatus was removed, and Dr. McBurney and I made careful and thorough tests of the fracture. The telescoping had disappeared and the crepitus could not be detected. There seemed to be a pretty firm union of some sort, though whether it was ligamentous or osseous we could not decide. The patient could not raise the limb from the couch with the knee extended, though she could rotate it through quite a considerable arc. It seemed that there was enough to encourage us to make a further effort. Before doing anything further, however, we decided to remove the apparatus for a couple of weeks, to see if any shortening took place. After nineteen days no shortening had occurred. The traction apparatus had brought the limb down to one-half an inch, or within one-quarter of an inch of its normal length; and for nearly three weeks, without any apparatus except the surcingle during the day, this length had been maintained. The patient went about on crutches. During the interval Dr. W. T. Bull also saw the patient and examined

the conditions present. Both he and Dr. McBurney deemed the evidence, while not positively indicating bony union, as affording a hope that this result might occur. On February 25th the treatment was again commenced, and it was steadily maintained until May 6th, when Dr. Bull again saw the patient. The conditions again seemed favorable, but not positively indicating bony union. There was no telescoping, no crepitus, no shortening under severe manual tests; indeed, there was some sort of union. It was hoped that it might prove to be bony union. Up to July 1st, when I went away on my vacation, the limb had not shortened. No direct evidence of fracture could be elicited, and yet there was an expressive disability about the limb which pointed to an uncertain result. It was proposed at this juncture to apply a perineal walking support, so as to maintain the advantage gained by the prolonged treatment; but the patient had had a previous very unpleasant experience with an apparatus of this kind, and positively refused to have one adjusted. After I went away the patient came under the care of Dr. Bull. The patient was instruccted to use the limb with the protection of crutches and to gradually bring the weight of the body upon the fracture. During the summer, under these conditions, the old condition gradually returned. The telescoping reappeared, the crepitus came back, and the thigh slipped back to its old position of three-quarters of an inch shortening. The result was a failure, after all.

It would seem, however, even in this case, where treatment was commenced eighteen months after the fracture occurred, that nature made an effort to secure union. It was a pretty firm union, too, and one which, for a while, resisted all ordinary tests. It may even be that had the treatment been absolutely uninterrupted, and had it been persisted in for a longer period, with a perineal support after actual treatment was stopped, a serviceable union might have resulted.

I do not propose on this occasion to review the various methods which have been devised for the treatment of fracture of the neck of the femur. Both these cases were *ununited* fractures, and they came under my care because the conventional method had failed. The means used were the result of some thought and study upon

the subject, and when I treated Mr. G. there was nothing that I could find in medical literature to guide or aid me.

Since my first case Dr. Nicholas Senn has published an able essay on "The Treatment of Fracture of the Neck of the Femur by Immediate Reduction and Permanent Fixation." This essay is published in the *Journal of the American Medical Association*, August 13, 1889, and it presents a comprehensive review of the subject, and the author reaches conclusions which I think the medical profession must approve as applied to recent cases of this class of fractures.

Dr. Senn depends, however upon manual traction for the first reduction of the fracture, and then adds a comprehensive gypsum splint, with a screw pressure over the trochanter major. No attempt is made to throw the fractured ends together by abducting the limb, and he depends upon the fixing power of the plaster-of-Paris splint to maintain the traction induced by the first manual effort.

What I deem to be the essential element in the treatment both of cases of recent and ununited fracture could not be successfully carried out by the use of the gypsum splint alone, viz., the permanent abduction of the thigh. The gypsum splint would not have sufficient resistance to hold the limb against the unremitting action of the adductor muscles. A constant and easily adjusted form of traction is needed to secure this result, and if this traction is successfully kept up the lateral pressure upon the trochanter may be very materially reduced.

A few words in closing. My experience leads me to say that the tourniquet pressure over the trochanter major will not produce any excoriation or any serious interference with the circulation. In neither of my cases did it produce anything more than inconvenience. Indeed, I was surprised to find how little pressure was needed to maintain the fragments in apposition with the conjoined rack-and-pinion traction and abduction. Still further: The long traction splint (Taylor's), such as is used in the treatment of hip-joint disease, with an abduction screw at the junction of the traction rod with the pelvic band, and with the surcingle and tourniquet, makes a complete apparatus for the treatment of recent cases of intracapsular fracture. It meets all the indications, and certainly, if good results can be obtained in cases of non-union of long duration, its

use is strongly indicated in acute cases. The ease with which the patient can be placed upon a bed-pan, etc., the certainty that the fractured ends can always be kept in apposition, the readiness with which the patient adapts himself to the treatment, the rapidity with which he gains confidence and walks about with the high shoe and crutches, and, finally, the absence of a complicated technique, all commend this method.

The above remarks were submitted to the Surgical Section of the New York Academy of Medicine on June 13, 1892. Since that time the following cases have occurred and are herewith appended to this report. The paper was not published, for the reason that it was deemed best to secure additional evidence before finally presenting the matter to the medical profession.

CASE III. Reported by Dr. T. Halsted Myers.—J. W. D., aged forty-two years. While driving the patient was thrown from his carriage and was stepped upon by the horse. Inability to stand and great pain were immediately observed. Nine weeks after the accident, on September 24, 1894, Dr. Myers found five-eighths of an inch shortening, bony crepitus, "telescoping" at the neck of the femur, and the characteristic position of fracture at the neck of the femur. On October 3, 1894, the long traction splint was applied, and the patient, who was obliged to support himself, went about on crutches, with a high shoe on the sound limb. A pelvic girdle was also applied soon after the treatment was commenced. On January 4, 1895, all pain had ceased and the telescoping and crepitus had disappeared. Although still advised to keep quiet, the patient had insisted upon going about on crutches. On January 25, 1895, a "short splint" was applied, the crutches and surcingle being continued. On May 10, 1895, the evidence of bony union being positive, all apparatus was removed. The patient had no pain and walked well.

At an examination made February 21, 1896, perfectly firm bony union was found, with excellent motion at the hip-joint. Patient rides horseback, etc., with ease. Shortening one-half inch.

CASE IV.—C. M., aged twenty-two years, a Norwegian sailor, applied at the New York Orthopedic Dispensary and Hospital on November 16, 1894, with the following history:

On May 24, 1894, he fell several feet aboard ship, injuring his

left hip. He was treated in a general hospital in this city for five weeks, with a plaster-of-Paris splint, the patient says, for dislocation of the hip-joint. After five weeks he was discharged, walking upon crutches. There was no further treatment, and the condition not improving, the patient applied to the dispensary as above stated.

On examination there was found one and one-quarter inches shortening of the affected limb, a distinct crepitation, nearly an inch of "telescoping," and the characteristic position of intracapsular fracture of the neck of the femur. This diagnosis was made and confirmed at subsequent examinations.

As the patient had no home, and was living in a sailor's boarding-house, it seemed useless to attempt to commence treatment. After a time I succeeded in obtaining permission to have the patient enter the Presbyterian Hospital, where, through the courtesy of Dr. Andrew J. McCosh, attending surgeon, the writer was permitted to give the patient his personal attention.

On January 21, 1895, nine months after the accident, with the assistance of the house staff of the hospital and Dr. Hibbs, house surgeon to the Orthopedic Hospital, a long traction hip-splint was applied, the surcingle belt was adjusted, the thigh abducted by making the distal perineal pad of the apparatus tight before making the traction, and the limb placed on an inclined plane at about 135°. At this time careful measurement showed one and one-half inches of shortening.

Dr. Hibbs assumed the personal care of the patient and saw him regularly.

On May 23, 1895, I examined the patient and found evidence of bony union. It was advised that the same treatment be continued, however, as it did not seem positive that the union was complete.

On July 30, 1895, bony union was complete; the patient could raise the foot from the bed with the knee fully extended. The use of the apparatus was continued, and the patient was directed to get up and move about with crutches and a high sole to the unaffected limb. There was three-quarters of an inch shortening.

As the patient had no home, he was kept in the hospital by the

kind permission of the authorities until December 17, 1895, when he was discharged well, with three-quarters of an inch shortening.

On November 17, 1896, when I saw the patient last he still had three-quarters of an inch shortening. At that time his gait was good, and he had been at work for some months. The bony union was very firm, and every function of the joint was well performed except that there was some limitation of motion at the hip in all directions. The knee-joint was about normal in its movements.

Other cases of impacted fracture accompanied by pain and great disability have been treated by this method with much success. Dr. Myers reports two, and the writer has had three, in all of which rapid improvement followed the use of the traction splint in a few weeks or months. In all these cases crutches, with a high sole, were used during locomotion.

FURTHER OBSERVATIONS ON THE USE OF THE THOMAS HIP-SPLINT IN THE TREATMENT OF FRACTURES OF THE NECK OF THE FEMUR.

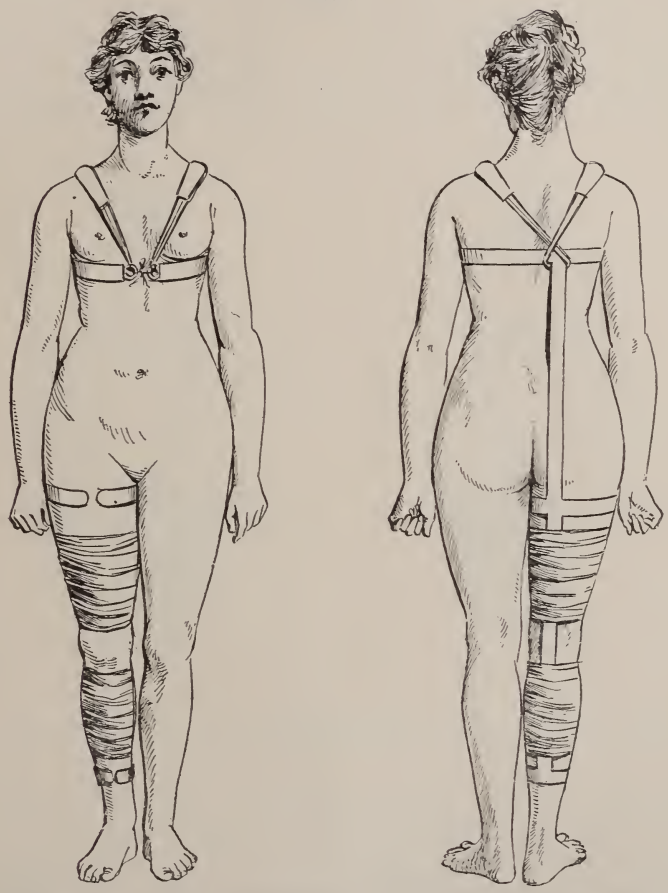
By JOHN RIDLON, M.D.,
CHICAGO.

In the *Annals of Surgery* for July, 1892, and the *Medical Recorder* for August, 1892, in conjunction with Mr. Robert Jones, of Liverpool, England, I reported twelve cases of fracture of the neck of the femur treated by the Thomas hip-splint. Since that time I have treated four additional cases. Before giving the details of these cases let me quote from my former paper, above referred to:

If one were to consider only the cases reported, and the other cases treated with the Thomas hip-splint, fracture of the neck of the femur would seem no more serious than fractures at any other part of the bony skeleton. As a matter of fact, however, when treated by the usual methods it becomes a very serious matter indeed. Cruveilhier, Colles, Lonsdale, and B. Cooper denied the possibility of bony union in intracapsular fracture; Sir Astley Cooper admitted its possibility. Hamilton says: "It seems to me probable that, under certain favorable circumstances, this union will occur. These favorable circumstances have relation to several conditions, such as age, health, degree of separation of the fragments, whether impacted or not, laceration of the periosteum and capsule, treatment," etc. But such a combination of circumstances is probably exceedingly rare. The most common results of this fracture are as follows: The bones are more or less displaced; the acetabular fragment absorbed as far as the head; the trochanter fragment appears flattened from pressure and friction; ordinarily the two fragments move one upon the other without the intervention of any substance; but often they become united, more or less completely, by fibrous bands, which bands may be short or long, according to the amount

of motion which has been maintained between the fragments while they are forming, or to the degree of separation which exists. Permanent shortening is the invariable result, and a few succumb to the injury within a month or two. Of the sixty cases collected by

Fig. 1.



Front and rear view of the Thomas hip-splint applied without fixed traction.

R. W. Smith, half died within the first eight weeks, and in all that lived the functions of the limb were permanently impaired. Stimson says: "Fibrous union after fracture is demonstrated by several specimens; ossification is merely the ultimate step in the involution of the granulations arising from bone, and it has been

shown in the study of failure of union, of pseudarthrosis, that the arrest of the process is commonly due to lack of immobilization, defective contact, or constitutional peculiarities of which old age is not one. Prolonged complete immobilization of a fracture of the neck of the femur is practically impossible; accurate coaptation of the fractured surfaces is a matter of chance, and the reason of the habitual failure to get bony union is to be found in the inability of the surgeon to meet the two principal indications of treatment, coaptation and immobilization, not any inability of the tissues them-

FIG. 2.

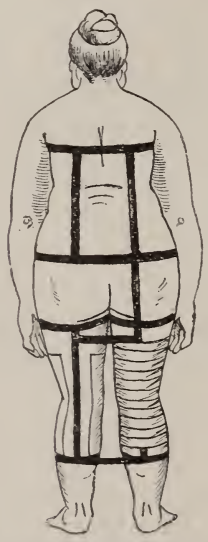


FIG. 3.

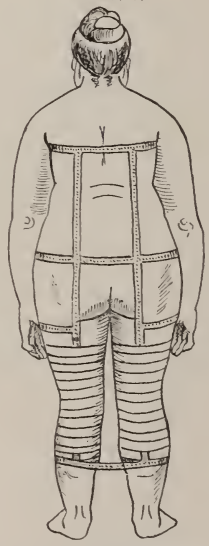


Fig. 2.—The double Thomas hip-splint applied.
Fig. 3.—The double Thomas splint with a section removed over the injured hip.

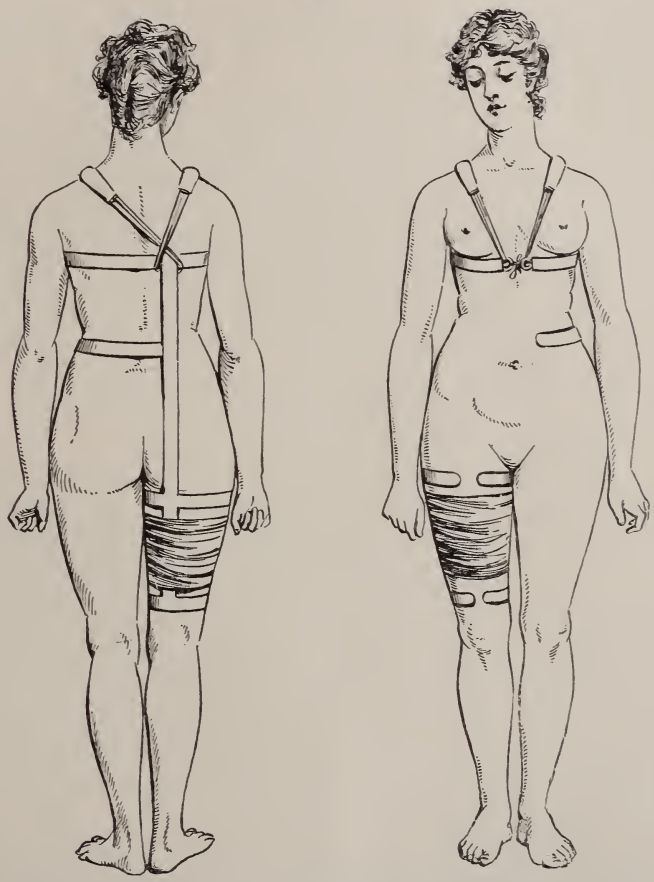
selves to do the work required of them. The common result of this fracture is permanent disability, more or less complete. The patient is sometimes bedridden because of the pain provoked by motion and the general feebleness which makes it impossible for her to get about on crutches; or limited use of the limb with the aid of a cane, or its place may be supplied by crutches. The foot remains everted, the limb shortened."

The relative frequency of fracture within and without the capsule is still undetermined; and inasmuch as the differential diagnosis is not made in the majority of cases, and inasmuch as neither prog-

nosis nor treatment is influenced by the location of the fracture, we will not consider the subject further.

The symptoms of fracture of the neck of the femur are: 1. Interference with function, which may be complete or only partial. 2. Pain,

FIG. 4.



The short Thomas hip-splint, for convalescence, with adduction wing added.

located about the hip or extending down the thigh. 3. Shortening, which may be only slight at first, but later may reach two inches. 4. Eversion, almost universally present to some degree. 5. Slight flexion and adduction; and 6. Crepitation, which may or may not be present, but should never be sought for. Post says (*Transac-*

tions American Surgical Association, 1883): "The surgeon, in his anxiety to obtain a perfect diagnosis, moves the limb freely in all directions; he overcomes the impaction, ruptures the cervical ligament, demonstrates beyond all doubt the existence of fracture, and effectually destroys all hope of union. For my part, I prefer an imperfect diagnosis for the surgeon and a perfect limb for the patient, rather than a perfect diagnosis for the surgeon and a useless limb for the patient."

CASE I.—On March 2, 1893, Mrs. B., aged sixty-two years, height five feet seven inches, weight 150 pounds, slipped on a wet wood sidewalk and fell, striking on the right side. She was assisted to arise and to walk some forty feet to her house, not being conscious of any serious injury. She then attempted, without assistance, to climb the few steps to her door by clinging to the hand rail, but at once felt something give way at the hip, and was then carried in and placed in bed.

Dr. H. P. Newman was called, and, having made out a fracture of the neck of the right femur, applied a long side splint and weight-and-pulley traction.

Two days later, March 4, 1893, at Dr. Newman's request, I applied a Thomas hip-splint with fixed traction. The patient suffered no pain, and on April 23d, seven weeks later, the splint was removed. The patient remained in bed still seven weeks longer, standing up for the first time on May 21st. For three months she used crutches, and for some time longer one crutch. After that, as the knee remained quite stiff, she used a cane for about two years.

Now, after four years, there is less than one-half inch shortening, she walks without noticeable limp, although the knee cannot be flexed to quite 90 degrees, and is in better health and strength than she has been for many years.

CASE II.—On August 18, 1886, Mr. McB., aged sixty years, occupation, milkman, while driving in a milk wagon collided with a runaway team; his wagon was overturned as he attempted to alight from the side door, and the top part of the wagon fell upon his left hip. He released himself and attempted to follow his horse, but fell, and was then carried to his home.

The patient was a weak and poorly nourished man, and had had several attacks of bronchitis during past years.

Examination of the injury by Dr. J. H. Walsh revealed a fracture of the neck of the left femur with two and three-quarter inches shortening. Weight and pulley extension and a long side splint were applied. The patient suffered a good deal and became so restless that at the end of two weeks I was called in consultation with Dr. Walsh.

A Thomas hip-splint, with fixed traction, was applied September 4th, two weeks and three days after the accident. The pain soon passed off, and the patient experienced much comfort in being able to change his position and move about on the bed.

On October 23d, eight weeks and three days after the accident, he was up, and a few days later walked with crutches. The splint was removed on November 1st, and on January 15th he resumed his occupation as a milkman. There was solid union of the fracture and but half an inch shortening of the limb.

Case III.—On February 10, 1897, Mrs. B., aged sixty-seven years, height 5 feet 7 inches, weight 186 pounds, fell on the icy stone walk, striking on the outer aspect of the left hip. She managed to get up, bearing her weight upon the right foot, when she fell again on the left side; again she got up and again she fell, striking on the left side. In this position she lay until a wheeled chair was brought, into which two men lifted her, and she was taken home and carefully placed upon a cot.

Somewhat more than twenty-four hours later I saw the patient in consultation with Dr. Sarah H. Brayton, the family physician.

The left leg lay fairly in line with the body (neither abducted nor adducted); the foot was rotated outward about fifty-five degrees, or from ten to fifteen degrees more than the opposite foot. Measurements, made with difficulty because of the fat on the abdomen and hips, gave a shortening of three-fourths of an inch, or less. Tenderness to pressure was present in front of the joint where there had been no possiblity of bruising; gentle rotation by rolling the limb under the hand caused pain at the hip, as did attempts at lateral movements of the limb. Left without disturbance the patient was perfectly comfortable.

A Thomas hip-splint, with buckles at the bottom for fixed traction, was ordered, and forty-eight hours later, three days after the accident, it was applied, with fixed traction adjusted. The patient

was then moved to her own bed without any discomfort. No pain or discomfort was felt after forty-eight hours.

On March 17th, five weeks after the accident, the splint was removed.

On April 10th, eight weeks and three days after the accident, the patient was sitting up in a chair, and on standing was able to bear some weight on the limb. Union was firm; there was between one-half and three-fourths inch shortening, and motion to about half the normal degree. Nine weeks after the accident the patient began walking with crutches.

Case IV.—On February 10, 1897, Mrs. DeG., aged eighty years, height 5 feet 4 inches, weight 155 pounds, fell on the icy stone walk, striking on the left hip. She was lifted by unskilled hands and carried about a hundred feet into her home and up one flight of stairs and put into bed.

A very prominent physician was the first to reach the patient, and after a very careful examination, during which the patient experienced much pain, the diagnosis of fracture of the neck of the left femur was made.

Somewhat more than twenty-four hours later I saw the patient in consultation with Dr. Sarah H. Brayton, the family physician. The patient was still suffering greatly from the shock of the fall; the left lower extremity was flexed, abducted and rotated outward into an extreme position; movement caused much pain; there was approximately two inches of shortening. The left shoulder was sprained so severely that the patient could not lift the arm from the bed.

Forty-eight hours later and three days after the accident a Thomas hip-splint with fixed traction was applied, with the limb pulled downward as far as possible.

Some pain was complained of for three or four days, after which the patient was remarkably comfortable.

The splint was removed on March 19th, five weeks and two days after the accident.

On April 10th, eight weeks and three days after the accident, the patient sat up in a chair for half an hour. Union was firm; there was motion to somewhat more than half the normal degree, and there was shortening of but half an inch, and no outward rotation

deformity. Nine weeks after the accident the patient was sitting up three hours daily, but being very timid had not attempted to use crutches.

Taking these results and those formerly reported under consideration, we think we are justified in saying that fracture of the neck of the femur is not so serious an accident, providing proper treatment can be had, as has heretofore been thought, and that as perfect results can be uniformly attained in these cases as can be had in fractures elsewhere in the femur and in the other long bones.

The principles of treatment are simple, and excepting impacted fractures are the very same as govern the treatment of fractures elsewhere, namely, as complete reposition of the frgments as possible, followed by immobilization until all the symptoms of the fracture have disappeared.

In impacted fractures it is believed by all surgeons, no matter what the plan of treatment selected, to be an unjustifiable procedure to intentionally disengage the fragments. In impacted cases, then, we must accept a certain degree of outward rotation deformity, and shortening to the extent of about three-fourths of an inch.

In unimpacted cases apposition of the fragments must, and generally can, be assumed when all antero-posterior, lateral, and rotary deformity has been corrected and nearly normal length of the limb has been attained.

To immobilize a fracture of the neck of the femur both body and limb must be so held that there is no antero-posterior and no lateral bending, and no rotary movement. In addition, fixed traction is essential, for with elastic traction or weight-and-pulley traction there must be a sliding of the fragments one upon the other when the muscles relax in sleep and again go on guard at awakening. In so far as I know, no device accomplishes all these indications except the Thomas hip-splint with fixed traction.

DISCUSSION.

Dr. R. H. Sayre said that the two preceding papers were very instructive and indicated an advance in surgery. Fractures of the femur certainly should get well as easily as fractures elsewhere, if treated on proper principles. He had recently treated an old lady with fracture of the neck of the femur by means of traction and immobilization in plaster, and had secured a useful joint. He had tried Dr. Shaffer's plan in one person, but he was intolerant of the treatment, and he could not report the result. He had experienced some difficulty in making proper pressure with the tourniquet It was also rather difficult to adjust the surcingle and the tourniquet within the pelvic band, and he could not make the desired traction without causing some slipping of the surcingle. The majority of the profession seemed to be still quite skeptical regarding the possibility of securing good union in fractures of this kind, and therefore patients with recent fractures were usually allowed to move around in bed at will. In the majority of cases, he thought, the splint should pass up above the pelvis in order to secure a proper control of the fragments and prevent their displacement.

Dr. A. J. Steele thought that possibly Dr. Ridlon's patient of sixty-three did not have the condition supposed. In some old patients who had injured the hip, the limb would be used for a few days, and then there would be a sudden development of the signs of fracture of the neck of the femur. This had led him to examine cadavers, and he had found in all a thickening of the periosteum running along the under side of the femoral neck, so that a pipe-stem fracture might occur without tearing of this figmental ligament for several days at least. By this thickened ligament it was possible that the fragments would be held together if proper care were not taken in the manipulations.

Dr. Shaffer said that he had presented a simple record of clinical facts, and he had waited eleven years in order to secure several cases before presenting the subject for consideration. There were not enough cases to justify conclusions. Ununited fracture of

the neck of the femur certainly could be successfully treated, even if that treatment were not begun for many months after the accident. He had experienced no trouble with the surcingle. A little piece should be cut out of the lower part of the surcingle in order to make it conform to the outline of the pelvis. It would then fit nicely, and should not cause any excoriation or slip when adjusted. Severe tourniquet pressure was only necessary at times when the patient was moved about in bed. In ununited fractures he regarded slight abduction of the limb an essential factor, as it tended to approximate the fragments. He would infer that Dr. Ridlon did not make any abduction at all in his cases.

Dr. Sayre asked if Dr. Ridlon used any perineal bands for counter-traction.

Dr. Ridlon said that in his hands the Thomas splint always had a tendency to slide down. When worn with the patient walking about, it was necessary to apply the shoulder-strap to support the weight of the splint. If used in bed, without fixed traction, the splint would always slide down. In using it in these cases of fracture, treated in bed, he did not employ any shoulder-straps, and the splint itself tended to slide down and make a certain amount of constant traction on the limb. In cases in which there was no impaction he pulled the leg down as far as possible, without giving an anæsthetic, and then he pushed up the splint until the thigh-band came up against the perineum. The tendency of this band, however, was away from the perineum. The chief advantage of the Thomas splint was that it allowed of lifting up the patient without any discomfort or any possible rotation of the fragments, and thus greatly facilitated attending to the calls of nature. In very fat women it was certainly very difficult in private practice to apply a plaster-of-Paris splint from the ankle to the axilla. On the other hand, the Thomas splint could be applied without assistants, without moving the patient at all, or giving any pain. The only advantage over the Taylor brace was that it did not seem to allow of as much motion at the hip-joint. He thought it had been demonstrated that the Taylor splint allowed of about 30° of motion at the hip-joint. The bar of the Thomas splint should be at least an inch and a quarter broad.

COXA-VARA AS A MANIFESTATION OF LATE RICKETS.

By REGINALD H. SAYRE, M.D.,
NEW YORK.

M. W., aged sixteen years, was seen by me in consultation on June 26, 1896, her family physician suspecting disease of both hip-joints.

The patient gave no history of traumatism, but simply of a progressive lameness of several months' duration, which had become so pronounced when I saw her that she was obliged to use two crutches in order to walk. She had suffered no actual pain, but grew tired very easily, and could in consequence walk but a very short distance, and this with great difficulty.

Examination showed her to be a thin, fragile girl, with normal temperature, rapid pulse, a slight rotatory lateral curvature of the spine, with projection of the right ribs and a very pronounced deformity of the hip-joints (as seen in the photographs).

The thighs were adducted to such an extent as to cross each other in the middle third, adduction being impossible, not on account of tension of the adductor muscles, but from the shape of the neck of the femora. In fact, it was difficult to separate the legs enough to place first one and then the other in front, the patient not being able to do so without assistance. There was no flexion of the thigh on the pelvis, nor restriction to rotation.

Her physician had supposed he was dealing with a case of double hip-joint disease of a peculiar character, but careful examination showed absence of muscular spasm, of pain on movement, and that restriction of motion was due only to the shape of the bones, not to resistance of soft parts, and I consequently made a diagnosis of coxa-vara.

The badly nourished condition of the girl and the commencing

Fig. 1.

Fig. 2.

lateral curvature suggested that the flexible condition in the bones might still be present. I accordingly advised that she be put to bed and traction made on both femora in the line of the deformity, and that traction also be made at right angles to the long axis of the femora, to see if it were possible to restore them to their normal shape without resorting to osteotomy. Iron, phosphorus and cod-liver oil internally were also ordered.

In the fall I heard from the family that the child's legs had become straight, and on December 6, 1896, received a letter from the family physician, saying: "Legs are straight. There is no desire to cross them. They are the same length. Would it answer for her to walk?"

I answered that I would not advise bearing weight on the legs for some months yet, and received word later from the physician that the lateral curvature, which had been slight, was becoming quite marked, although the girl had been in bed since June.

I wrote in April to the family physician to make an appointment to examine the case at her country home, in order to see exactly the condition of the joints, but received a telegram stating that she was dead, and that he would give particulars in a letter. The letter I have never received, and am therefore unable to complete the report of the case as I had wished.

ADOLESCENT RICKETS.

Report of a Case.

By JOHN RIDLON, M.D.,
CHICAGO.

The condition known as adolescent rickets has been recognized clinically for many years, but of its etiology and pathology very little is known. As its name implies, it has been assumed to be rickets appearing at the time of adolescence. The assumption has been a very natural one, since so little has been known of a certainty concerning the etiology of rickets, and since some of the deformities of adolescent rickets closely resemble some of the deformities of the ordinary rickets of early childhood.

The following case is a characteristic one of adolescent rickets, and the Roentgen photographs show very clearly the condition of the bone and its difference from ordinary rickets:

E. H., male, twelve years old, first seen by me on February 1, 1897. The family history is clear of tuberculosis and rickets. The patient never had any special or serious sickness. When about seven years old it was noticed that he began to limp and stepped on the toe of his right foot. About a year and a half later, when about eight and a half years old, he was examined by Prof. N. Senn. The mother thinks there was some question as to the diagnosis, but was told that it was incipient hip disease. She is sure that there was no difference in the measurements of the two legs at that time. She was instructed as to treatment by weight-and-pulley traction at night, but told to let the boy continue out-of-door exercise. No brace was applied. Later on the boy was circumcised. Six months ago the mother first noticed outward bowing at the right knee, and that he leaned to the right in walking. There has never been any pain or tenderness, or night-cries.

Fig. 1.

Shows changes in upper end of femur. Trochanteric region thickened and of less density; the femoral neck has disappeared, and the head is depressed. Acetabulum appears to be normal.

Fig. 2.

Shows changes in upper end of the tibia. In addition to the outward curve there is an irregular, notched surface, with two transverse lines, in addition to the epiphyseal line, of less density than the rest of the bone. The femur appears to be normal.

Examination. Stands with right knee slightly flexed and bowed outward, and right hip somewhat lower than the left. The thigh can be flexed to a right angle; rotation very nearly normal. No muscular spasm, and the restriction of motion appears to be bony.

Measured. Anterior superior spine of ilium to inner malleolus gives one inch shortening; from tip of great trochanter to external condyle, no shortening; tip of internal condyle to inner malleolus, one-half inch shortening. The circumference of the right thigh was three-quarters inch less than the left, and the right calf one-quarter inch less than the left.

The Roentgen photograph (Fig. 1) shows the condition of affairs at the hip. The head of the femur is depressed; the neck shortened, and the trochanteric region thickened and somewhat lessened in density. There does not appear any evidence of present or past disease of the hip-joint itself. Fig. 2 shows the condition of affairs at the knee. The upper end of the tibia is thickened; less dense, has irregular notches and projections at the sides, and three transverse lines somewhat resembling the single lines that appear at the epiphyseal junctions of bones in young children. Comparison of these pictures with the Roentgen pictures of the ordinary rickets of young children demonstrates the marked difference that exists between the two conditions.

In cases of ordinary rickets, when the leg bones are affected the deformity chooses the lower end of the bone, or at least the lower half, in the vast majority of cases. In adolescent rickets the deformity almost uniformly attacks the upper end of the bones, and in-knee or out-knee may result. When the upper end of the femur is attacked there is a depression of the head of the bone and a shortening and distortion of the neck, with, in some csases at least, thickening of the trochanteric region. I am not aware that adolescent rickets has been observed in any other regions except the upper end of the tibia and the upper end of the femur, unless on investigation it be shown that true scoliosis is a manifestation of adolescent rickets. On the other hand, the ordinary rickets of young children attacks many bones in many parts, and in well marked cases practically all the bones of the skeleton are more or less distorted.

Despite the statement of Rotter and Lauerstein (*Arch. f. Klin.*

Chir., Berlin, 1890, Bd. xl.), that they have proved by microscopic examination that adolescent rickets is really rickets, we may have a reasonable doubt as to the identity of the two conditions when we view them clinically and by the aid of the Roentgen pictures.

DISCUSSION.

Dr. Goldthwait presented a photograph showing the attitude of a case of coxa-vara.

Dr. Henry Ling Taylor said that he noticed in the skiagraph showing the three transverse lines at the epiphysis, that there were other transverse lines in other parts which appeared to be due to imperfections in the photographic film. He said that the skiagraph of the hip resembled that of fracture of the neck of the femur in a child.

Dr. R. H. Sayre asked if any fluorescent screen had been used in making the skiagraph.

Dr. Ridlon said that so far as he knew the plates were simply enclosed in the yellow paper, and he did not think any fluorescent screen had been employed. Regarding the case of the boy in which the question of fracture was raised, Dr. Ridlon said he had watched him for some time, and there was no history of injury, and no restriction of motion existed except abduction. Then the joint became tender, and motion was restricted in every direction. The long traction hip-splint was applied. In less than six weeks all restriction of motion, except abduction, had disappeared.

GUNSHOT INJURIES OF THE TARSUS.

By J. D. GRIFFITHS, M.D.,
KANSAS CITY.

I HAVE made some experiments during the past few years with the 30-calibre gun used by our infantry and cavalry. The gun fires 34 grains of powder, and the ball weighs 220 grains. At the present time, nitro-cellulose, or Peyton powder, is used. This gun easily kills at a distance of 3000 metres. The photographs exhibited were taken on the field *in actual work*. They showed the method of destruction of any ball. At a distance of from 25 to 1000 yards the photograph showed the steel balls had been torn to pieces, although they would go through a man and forty inches of earth without being altered in shape. A plate of chilled steel, three-sixteenths of an inch, would be perforated easily by this bullet. A series of photographs were then shown illustrating perforations of the feet and leg by the projectiles from this gun. This gun, he said, was originally adopted as a "humane" gun, but there was nothing humane about it. The wound which it produces, instead of being of the old cone-shape, is diamond-shaped —in other words, the bases of the cone are in the centre of the wound, and the apices correspond respectively to the wounds of entrance and exit. This must necessarily change the surgical treatment of such wounds. This change of shape in the wound would be found in all the various internal organs. Specimens were exhibited showing the bones of the skull almost ground to powder by one shot from this gun. Yet this was not the most destructive weapon—the shrapnel gun was much worse. Dr. Griffiths said that he had tried it at a distance of from two to three miles, and had found it easy with it to kill sheep, dogs, and horses. The ball could be easily destroyed, however, by any man, who could extemporize in a few minutes out of loose earth a perfect shelter from a

shower of these missiles. The loose earth tears the new steel bullets and the inner lead cores into pieces. Photographs also showed that even with rapid firing there was no smoke.

DISCUSSION.

Dr. R. H. Sayre said that the paper was exceedingly valuable, because the results embodied in it were so much at variance with those reported by other investigators. It had been stated by others that the weapon had a very destructive force at short ranges, but only a mild force at a somewhat longer range. This paper showed there was no intermediate range of comparative harmlessness.

AN ENGLISHMAN'S VIEWS OF ORTHOPEDIC SURGERY AS PRACTISED IN AMERICA.

By NOBLE SMITH.
LONDON, ENGLAND.

When I suggested the above title for this paper I thought of discussing a variety of points which had occurred to me in reading the Transactions of the American Orthopedic Association, and I even commenced a paper upon these lines. I soon found, however, that any observations which I could make would be better fitted for personal discussion than for a contribution in my absence, and, therfore, I have restricted my remarks chiefly to bringing before the notice of the Association some of the principles upon which I have been dealing with various deformities involving the spine.

I offer my opinions with great deference to American orthopedic surgeons, for they have undoubtedly made great advances in the study and practice of orthopedics. They have taken, it seems to me, greater strides in this department of surgery than in any other, and upon the whole have done far more work in this line than we have here in the old country.

This result is, I believe, due to several causes:

1. Americans are, as a rule, practical men, giving less time to the study of theoretical subjects than to the practical application of their profession, and orthopedic surgery is essentially a practical branch of surgery.

2. Americans are not trammelled by the prejudices which appertain to the profession in this country, so that every surgeon who has the necessary mechanical aptitude has nothing to prevent him from turning his attention to the study of orthopedics, for he is not afraid of trampling upon traditional fallacies.

3. Orthopedic surgeons in America have devised and worked

out the details of construction of the apparatus which they use, and have not depended, as most of us have in England, almost entirely to the genius of instrument-makers.

For generations it has been the custom of some surgeons to condemn the apparatus used in the treatment of orthopedic cases, and

Fig. 1.

Showing the lateral curve.

yet very few of them have taken the trouble to devise something better or to study how to do so.

In illustration of this observation I propose to take, for example, the treatment of scoliosis and kyphosis. There can be no doubt

that monstrous and most complicated instruments have been made by mechanicians, and that the condemnation of these machines by medical men has been well merited.

What has been the result? Practitioners have tried to do without mechanical help, and have failed. They have used what they

Fig. 2.

Showing the depression of chest and roundness of back in the felt jacket.

have imagined to be simple supports, namely, jackets of all sorts, and especially felt jackets, misnamed *porous*, and they have thus combined many of the evil qualities of the mechanical corset without giving efficient support to the upper part of the trunk.

I append photographs, with a description of a typical case, to show the failure of the jacket and the effectiveness of an apparatus constructed upon surgical principles.

In regard to this subject it might be said that in attempting to eulogize American orthopedic surgeons I am overlooking the fact that the use of "plaster-of-Paris jackets" emanated from America. This, of course, is true, but the very fact that the invention was the outcome of an honest endeavor to devise a useful apparatus exemplifies the desire of American surgeons to deal with the mechanical details of their work themselves, although one cannot approve of the plaster jacket.

If I were attempting to criticise all the orthopedic apparatus invented in America I might, rightly or wrongly, express differences of opinion as to the exact form of some of these instruments, but my object is different; I wish merely to urge that the only way to obtain good results in the matter of construction is for the surgeon to devise and supervise the details of the work himself, and to insist upon the apparatus being made in such a manner that he can himself bend and alter them to his own satisfaction.

To the members of the American Orthopedic Association these remarks may seem superfluous, but if they will only indorse the opinion expressed it will do much ultimately in helping forward orthopedic methods in Great Britain as well as in America.

I must express my admiration of the work done by this Association as shown in its TRANSACTIONS—a record of orthopedic surgery which no writer can afford to ignore when treating at any great length any subject connected with this department of surgery.

The following photographs show the ineffectiveness of the ordinary "felt jacket" in controlling the position of the spine, and the immediate effect of applying the "adaptable metal splint." This splint has the following advantages:

1. It leaves room for action of the muscles.
2. It develops the chest and does not press upon it.
3. It prevents the spine from subsiding into bad positions.
4. It forms a fixed basis from which to apply pressure upon the lateral curves.
5. It enables the surgeon to see the effect upon the spine while the apparatus is *in situ*.

6. It is made of steel, the lightest metal for the purpose, and is so tempered that it can be bent into any form by the surgeon himself.

FIG. 3.

Showing the immediate effect of putting on the "adaptable metal splint."

7. It is comparatively light, and is so helpful to the patient that a weak child can do more with it on than without it.

N. B.—Whatever position the spine can be held in by the metal splint, it will in time become permanent.

OPERATIVE PROCEDURES IN ORTHOPEDIC SURGERY.

By V. P. GIBNEY, M.D.

Without wishing to renew any unpleasant discussion on the subject I have chosen, I do feel that it is necessary to keep before the medical public, for the dignity of our specialty, this one proposition: That the orthopedic surgeon is prepared to conduct a case from its incipiency to its close; that, if apparatus fails to meet the indications, he is able to conduct an operation, which operation ought to be done as well as any general surgeon can do it, and which operation can be supplemented by the judicious use of mechanical appliances, in order to bring about the best possible result.

I have no wish whatever to deny to any of my fellows a special predilection for apparatus alone, or for apparatus combined with minor operations, or for operations alone; but I do feel that if our specialty is to make any advance and is to maintain its position in the medical and surgical world, an orthopedic surgeon must be prepared to meet any emergency that may arise. The advantages which such a discussion presents on an occasion like the present are manifold. Methods of procedure may be suggested. The best time at which an operation should be done may be set forth with decided benefit, just how to supplement an operation with apparatus, when to abandon the use of apparatus, etc.

It occurred to me when I gave to the Secretary this title for my paper, that statistics of the operations performed at the Hospital for the Ruptured and Crippled might be of value, but as time passed and as the opportunities for securing final results were lost, I concluded to postpone the statistics so far as results go, and to present some of the indications for operation. I am not averse to this plan, because I know that it is exceedingly difficult to secure accurate final results. Among the class of cases with which we deal one never knows when a result is final. In many instances,

it is true, we can approximate the final results, but a given set of cases may be reported upon, say three or five years after operation. Another set may be reported upon eight or ten years afterward. Then, again, these earlier cases may be subjected to still further report. For this reason I say the actual value of statistics is not so great, according to my way of thinking, as one is led to suppose. I find, by referring to the operation-book at the hospital, that 515 cases of hip disease have been operated upon during the past ten years, and of this number of patients there have been 828 operations, showing that many of these have been subjected to second, third, and fourth operations. Going more into detail, 120 of these patients were operated upon for abscesses and sinuses; 99 for deformity, the operation being an osteotomy below the trochanter minor; 69 were subjected to myotomy and tenotomy for the correction of deformity. In 107 the deformity was forcibly corrected under an anæsthetic. In 119 an excision was done for the removal of the disease. The excision cases will be reported at this meeting by Dr. W. R. Townsend, of the attending staff. Only a single case was operated upon by an exploratory incision. In one case only an amputation was performed *in extremis.* This was an unfortunate patient, who was practically dead when he was anæsthetized. It was hoped that the removal of the member, which was simply hanging by shreds, would save life, but it failed. This leads me to devote a little time to the question of amputation in advanced cases of hip disease. A specimen I present, which is an illustration, and the history is, briefly, as follows:

A boy, five years of age on February 24, 1896. His father was a consumptive; mother reported healthy. His disease of the hip was of three or four months' standing, marked by night-cries and inability to walk. It was possible to extend the hip to 120 degrees, but yet it was very painful. There was much spasm. The right limb was practically an inch shorter than the left, really the same length. He was treated by weight and pulley; by the second of June his angle of deformity was about 145 degrees, and he was put on weight and pulley. We failed to accomplish much, and under ether, March 18th, his limb was brought down with very little force and put up in plaster-of-Paris. On June 2d an abscess was discovered on the outer side of the thigh, and this was aspi-

rated a day or two later. The abscess refilled in a week or two, and his condition was so poor, it was decided to make a free incision. The sac was pretty well dissected out, and no bone was removed; in fact, no diseased bone could be discovered in the abscess sac or in the sinus. His condition remained poor for some time, and he went to the country in the summer. In the fall he was very much improved. In October he had scarlet fever, and went to the Willard Parker Hospital. There was still a discharging sinus on the outer side of the femur. He was taken home from the Willard Parker Hospital and was re-admitted some weeks later to the Hospital for the Ruptured and Crippled. His condition was wretched, and there was profuse discharge from the sinus in the groin, which sinus led up to and around behind bare bone. The discharge increased during the spring. His liver became enlarged, and on March 1st the question of amputation was considered. In fact, on March 9th he was put upon the table for this purpose, but his strength was so very feeble that the operation was abandoned, and he died on April 29th.

It has often occurred to me that life might be saved by a judicious and timely amputation. It is all very well to talk about excision curing cases of hip disease. It is all very well to present a case now and then where the operation was done as a *dernier ressort;* but there are cases now and then where no excision will save life, where the disease is so far advanced and involves so much of the pelvis and so much of the shaft of the bone, that it is idle to attempt an incomplete operation like excision. Thus, how to decide when such a case is suitable for amputation is a very perplexing question. The indications are not always clear. One cannot always tell just how much bone is involved. One cannot always tell how great are the powers of the patient's resistance. In this uncertainty we are tempted to wait until further progress is made. During this period the disease may or may not extend. If it does extend, then the time comes when all hope is abandoned and an amputation is simply out of the question. In the case whose history I have just presented, I had the counsel of Drs. William T. Bull and W. B. Coley. The patient was on the table for amputation, and they advised me to desist. I was perfectly willing to take their advice, because I felt that it would be merely a reproach to surgery, and

that no good could be attained. Exploratory operations with a view to determining the extent of disease are usually followed, unless great care is taken, by sepsis, and then an amputation is too late. I am free to admit that in certain hospitals where the worst cases are not admitted, this question may be solved, but if the hospital receives all cases as desperate as this one, and is willing to admit even the most advanced, for the sake of giving relief to the crippled and the family of the crippled, then instances will arise where the question cannot be decided.

One feels that in this stage of advanced surgery a child should not die of hip disease. If tubercular meningitis develops, then we are helpless; but to have a case suppurate and continue to suppurate, and not be able to remove the cause of suppuration, we feel loath to admit such a possibility. It has frequently occurred to me that there was something wrong about the air of a hospital; that tuberculous patients are allowed to remain too long in its wards; that changes should take place. A child in such a stage of advanced disease should be sent home and provision should be made for a moderate degree of cleanliness and home treatment. Certain I am that in private practice such results do not, as a rule, occur. Whether it is that the hygienic surroundings are better than in a dispensary or hospital practice, whether a physician can command better facilities for the care of the case in private practice, or not, I am unable to decide.

I ask, therefore, for a discussion upon the indications for amputation, and hope that some light may be thrown upon this intricate subject.

The operations for tuberculous disease of the vertebræ resolve themselves into evacuation of abscess, thorough removal of the walls of the abscess, removal of the focus of disease, and finally the correction of deformity.

At the hospital there have been 69 cases operated upon, the number of patients being 86; 71 abscesses were operated upon, 14 sinuses curetted, and one case of deformity of the lower limb. Twelve of these cases of sinus and abscess underwent two operations, three, three operations. The indications for operative interference in abscesses are not always as clear as one might imagine: the reason that one can never tell just when the focus of disease

has ceased to throw off the products of disease. We surely wait some length of time before interfering surgically, unless it be that aspiration may be regarded as a surgical interference. Here we aspirate frequently, and when the contents are too thick to be removed through a large needle, an incision is usually made. Occasionally we have a brilliant result—more frequently a disappointing one. It must not be understood that attention is not given to the bone disease itself, for in all cases an attempt is made to fix the column, and especially that portion of the column invaded by disease. It not infrequently happens, as all present will attest, that abscesses disappear under protective treatment. I am perfectly safe in stating that time is usually given for the abscess to disappear, but if, after a certain length of time, varying according to circumstances, this result is not attainable, then interference is resorted to. In only a few instances have I attempted to remove the focus of disease, but I must say that satisfactory results have not followed.

In tubercular disease of the knee, including the bones adjacent thereto, the various operations are resorted to, such as aspiration of abscess, correction of deformity, evacuation of abscess, removal of the focus of disease, excision, amputation. There have been, during the period mentioned, 211 patients operated upon, 356 operations.

In tubercular disease of the knee the question of amputation is not always so difficult to decide. If, after repeated curettings, supplemented by adequate protection to the parts, the best hygiene we can command, the disease progresses and seems to involve the shaft of the femur as well as the shaft of the tibia, and the effects of prolonged suppuration are already manifest in the internal organs, such as the liver and kidneys, there is no question in my mind as to the advisability of amputation; and in a number of instances this operation has been performed with gratifying results. By this I mean that the disease has been arrested, the liver has become small, the urine has lost its albumin, and the child has grown fat and hearty.

Similar remarks may be made upon disease of the elbow, shoulder, and the ankle.

With regard to the deformities which are congenital, and which

result from paralysis, it may be said that operative interference is more frequent. For instance, in club-foot, there have been 368 patients operated upon with 471 operations. The favored operation is tenotomy. The next in order comes correction of the deformity by manual or mechanical force under an anæsthetic. Bone operations are more or less frequent, according to the amount of resistance offered. Cuneiform osteotomy has been done ten times. Phelps' operations two or three times. The supra-malleolar osteotomy has been done in a few instances, and in sixteen cases arthrodesis has been resorted to in paralytic club-foot. This operation, as a rule, yields good results, but the results are not as perfect as one is led to believe, because of the difficulty of securing synostosis at the mid-tarsal region. If anchylosis could be secured in the tibio-tarsal, much would be gained; but the foot requires further treatment before a result which one would be proud of can be secured. After all, the subsequent treatment by mechanical device is necessary, and this must extend over a long period of time.

In paralysis of the limbs, resulting from poliomyelitis or hemiplegia, good results are often obtained by the judicious division of muscles and tendons, by the transplanting of tendons and muscles, and by the subsequent employment of protective apparatus. Fifty-six patients suffering from deformities of this nature have been operated upon, 78 in all. In wry-neck, or torticollis, 16 patients have been subjected to operation, 18 operations in all. Eleven have been cured, 5 improved. The operation usually employed is subcutaneous tenotomy or myotomy. In a few instances the open method has been employed, and always with satisfactory result.

Sundry operations have been performed upon deformity of the hands, upon cervical abscess, on webbed fingers, perinephritic abscess and hammer-toe, and upon such other deformities that ultimately come within the scope of this specialty.

I have made no attempt to give all the operations, but to indicate in a general way what is the scope of operative procedure in deformity and in diseases which lead to deformity.

With the rapid progress made in surgery it does seem that the orthopedic surgeon should succeed in curing a larger number of cases if he takes advantage of these procedures and supplements his operations by the appropriate use of mechanical devices.

FURTHER OBSERVATIONS ON FRACTURE OF THE NECK OF THE FEMUR IN CHILDHOOD, WITH SPECIAL REFERENCE TO ITS DIAGNOSIS AND TO ITS MORE REMOTE RESULTS.

By ROYAL WHITMAN, M.D.,
NEW YORK.

In 1890, at a meeting of the Orthopedic Section of the New York Academy of Medicine, I presented a case of fracture of the neck of the femur in a boy eight years of age, and again in 1892 four cases in children from two to six years of age before the members of the surgical section. Since that time five others have come under my observation, and I again present the subject for discussion.

The nature of the injuries sustained by these patients and the character of the symptoms and appearances observed were, in brief, as follows:[1]

Case I.—A boy, aged eight years, was brought to the Hospital for Ruptured and Crippled in the arms of his mother, on May 20, 1890. Six weeks before he had fallen into an area, a distance of fourteen feet, injuring the right leg. He was put to bed and treated by a physician, who devoted his attention to the knee, which was said to have been swollen. Later another physician was called, who pronounced the condition hip disease and said that it was incurable. On examination it was noted that the leg was rotated outward, that the trochanter was elevated three-fourths of an inch above Nélaton's line, and was somewhat nearer the median line of the body than its fellow. Passive motion of the

[1] The more immediate effects of the injury in Cases I. to V. have been reported: "Observations on Fracture of the Neck of the Femur in Childhood, with Especial Reference to Treatment and Differential Diagnosis from Separation of the Epiphysis," Medical Record, July 25, 1893.

limb caused pain, but was unrestricted except in extreme flexion and inward rotation. The head of the bone was evidently in its place. A hip-splint was applied, on which the child immediately began to walk. Six months later it was discarded.

Two years later, October 20, 1892, motion at the joint was practically normal. It was said that the child complained somewhat of stiffness after long sitting. This was explained by the marked projection of the trochanter, which distended the gluteal region when the leg was flexed. Otherwise the child suffered no discomfort. There was a slight limp and one-inch shortening, an apparent increase of one-fourth of an inch since the first examination. The legs were three inches longer than in 1890. The present condition of the patient will be considered later.

Case II.—A boy, aged six years, was brought on November 9, 1891, to the hospital, on account of a persistent limp. Four and a half months before he had fallen from a fire-escape, a distance of fourteen feet, the accident having been followed by swelling of the right thigh, pain, and inability to stand. A plaster-of-Paris bandage had been applied and had been worn for eight weeks; on its removal the boy appeared well, with the exception of the limp.

The examination showed, as in the preceding case, slight outward rotation of the limb, prominence of the trochanter, which was elevated three-fourths of an inch above Nélaton's line, with two-thirds of an inch displacement toward the median line. There was no limitation of motion, except in extreme flexion and inward rotation. A brace was worn for three months, and then removed. The child was examined on December 10, 1892, one year later. The shortening then was one and one-fourth inches, the other leg having increased one and a half inches in length. The only symptoms remaining were the limp, caused by shortening, and a slight limitation of motion.

Case III.—A boy, aged five years, was brought to the hospital December 28, 1891; he was said to have been thrown down or run over by a heavy carriage nine weeks before. At this time there was pain and swelling of the right thigh, for which a plaster bandage was applied; it was removed two weeks later. The patient had since walked with marked limp, and suffered more or less pain. Examination showed the leg in full extension, somewhat rotated

outward, three-fourths of an inch shorter than its fellow, with a corresponding elevation of the trochanter, which was, however, less prominent than in the preceding cases; motion was much more limited, terminating at 100° of flexion, and the muscular resistance was more marked.

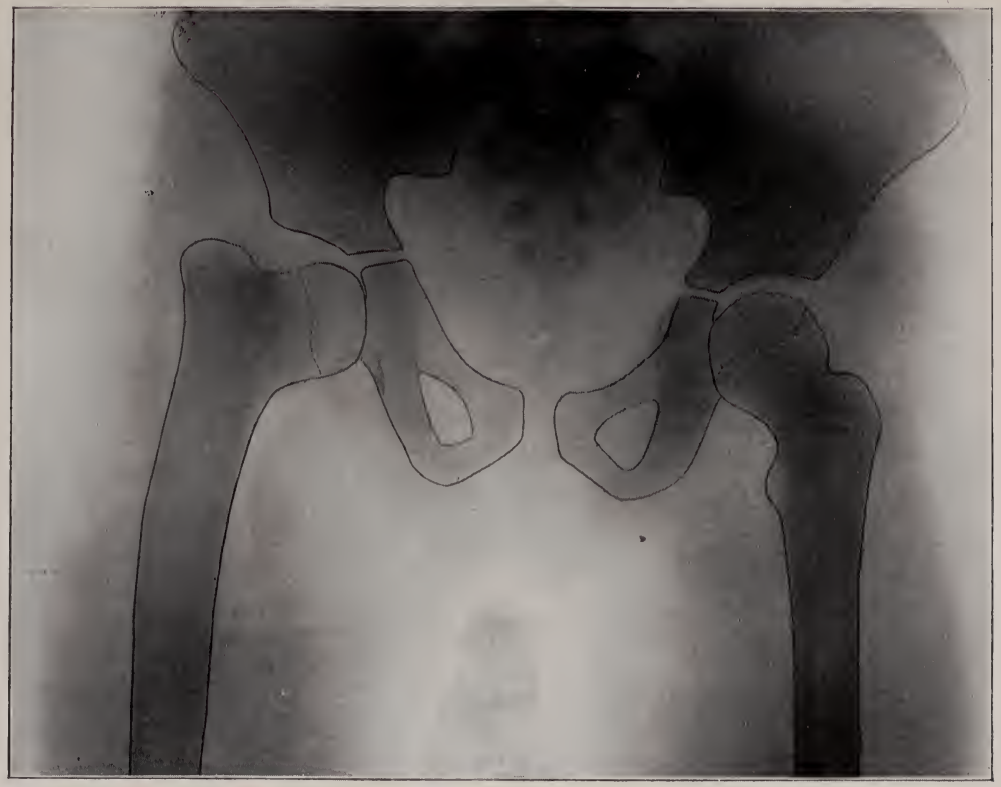
In this case it was inferred that the upper extremity of the bone had sustained more damage than in the preceding cases, and this was borne out by the after-history; the spasm and resistance to motion necessitating the use of a brace up to the present time (December, 1892). The range of motion is now normal in extension, but is somewhat limited in flexion. The relative shortening is as on the first examination. The present condition of the patient is unknown.

Case IV.—A boy, aged eight years, applied at the hospital, October 8, 1892, with a history of a fall of about fifteen feet six months before, followed by pain and disability, for which he had been treated at the Gouverneur Hospital.

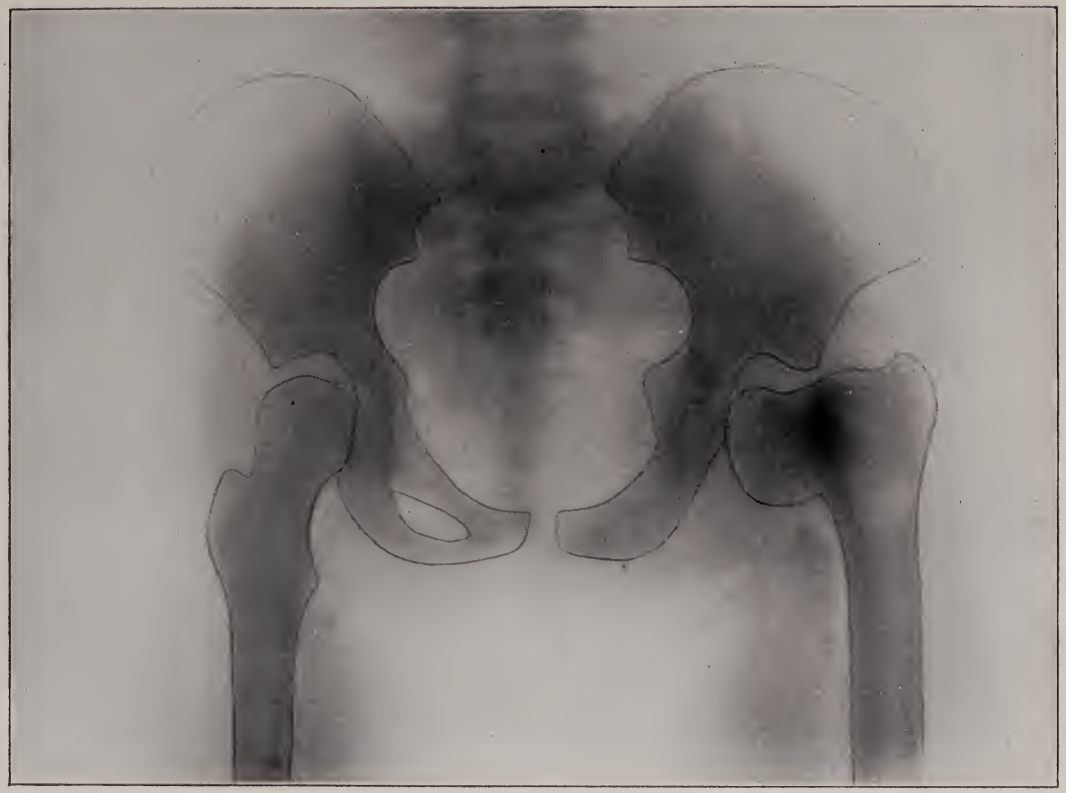
The physical signs were very similar to those of the preceding case. The right trochanter was elevated one inch above Nélaton's line, there was marked thickening about the joint and muscular spasm on motion. The leg was fully extended and rotated outward.

Dr. Silver has kindly furnished me with the record of the case. On the child's admission to the hospital he was anæsthetized, and a diagnosis of fracture of the neck of the femur at its junction with the shaft was made. There was distinct bony crepitus at this point, and the trochanter rotated on its own axis. At first Buck's extension was applied, but as the child was unruly a plaster-of-Paris spica bandage was substituted. On its removal the boy walked fairly well, but as the pain and limp had recurred since his removal from the hospital, some support was thought necessary. This, as in the preceding case, was applied, and at once relieved the pain and night-cry. It was discarded about two months later. The condition of the patient at the present time will be described in the consideration of the remote results of the injury.

Case V.—A boy, two and a half years of age, was brought for examination in October, 1892. One month before he had fallen from the fourth story of a house, but did not appear to be seriously injured. He had since limped and complained of pain and fatigue



Skiagram of patient No. 5, four years after the accident, illustrating the deformity of the neck and of the upper extremity of the shaft; also the elevation of the pelvis on the affected side.



Skiagram of patient No. 8, fifteen months after the accident, illustrating the depression of the neck of the right femur. Outlines traced on both skiagrams.

in the left leg. Examination showed outward rotation, but absolutely free motion of the hip, three-fourths of an inch shortening, with the elevated and prominent trochanter as in former cases. A modified hip-splint was applied, which relieved the symptoms. It was worn for six months. One year later there was no increase of shortening, and no symptoms were apparent. The present condition will be mentioned later.

CASE VI.—A girl, six years of age, was seen at the Vanderbilt Clinic, September 4, 1894. Five months before she had fallen down a flight of stairs, and being unable to walk was placed in bed. No immediate diagnosis was made; later, after consultation, the child was said to have hip disease, for which she had been treated by rest in bed with traction for several months. The examination showed limp, an elevated and prominent trochanter, three-fourths of an inch of shortening, and slight eversion of the left leg. Motion was unrestricted. The mother did not again bring the child for treatment. A final examination was recently made, two and a half years after the accident (January 28, 1897.) There was no decided change in the physical signs. There was, however, an increase of one-fourth of an inch shortening, slight eversion of the foot, and slight restriction of abduction. No discomfort or disability was complained of.

CASE VII.—A girl, five years of age, was seen at the Hospital for Ruptured and Crippled, September 12, 1895. Five weeks before the examination she had fallen down stairs and had injured the left leg. She was kept in bed two weeks, but then began to walk about as usual. She was brought to the hospital because of the limp and slight discomfort. The shortening was one-half an inch, with elevation and prominence of the trochanter, as in the former cases. She was not again seen, nor could she be found for a later examination.

CASE VIII.—A girl, three and a half years of age, was seen at the Vanderbilt Clinic on September 21, 1895. About three weeks before she had fallen down a flight of stairs. There was no immediate treatment other than rest. She presented the usual signs of united fracture of the neck of the right femur. The shortening was three-fourths of an inch. A plaster spica bandage was applied and worn for two months. There was no further treatment. At

the final examination (January 31, 1897) the shortening was one inch; there was still very slight limp. In this case there was marked restriction of abduction, for which the mother was instructed to employ forcible manipulation, and an increase of one-fourth of an inch of shortening, showing that a hip-splint should have been applied to remove the weight of the body from the vulnerable bone.[1] (See Fig. 9 and skiagram of patient No. 8.)

Case IX.—A girl, eight years of age, was seen at the Hospital for Ruptured and Crippled, October 12, 1895. Six weeks before she had fallen about ten feet, injuring the right leg. There was much pain referred to the hip and knee. Two days later she was taken to a hospital, but no diagnosis was made. Since then she had remained in bed and been rubbed with liniment.

Examination showed signs as in the preceding case, the shortening, however, being but half an inch. The mother did not again bring the child for treatment. At a recent examination, January 28, 1897, one year and a half after the accident, no disability remained. There was slight eversion of the foot, elevation and slight prominence of the trochanter. Motion was not restricted. The shortening had not increased. The mother stated that the child continued to limp and complained of pain for nearly a year after the accident. This is the most favorable result of the cases reported.

Case X.—A girl of seven years was seen at the Hospital for Ruptured and Crippled, September 16, 1896. Six weeks before she had fallen from the third story of a house and had injured the left hip. She was in bed nine days. No immediate diagnosis was made. She was afterward under treatment for hip disease.

The usual signs of fracture were present. There was no pain and no restriction of motion, a very slight limp, and one-half inch of shortening. She was again seen February 2, 1897. The treatment for hip disease had been discontinued. No disability was apparent, and no increase of shortening. A well-marked tilting of the pelvis was present, due to the shortening.

These ten children were seen by me at intervals of from three weeks to six months after the accidents. In but one instance had

[1] As the prominence of the trochanter appeared to become more marked, on August 3, 1897, two years after the accident, I removed a cuneiform section from the base of the trochanter in order to replace the neck of the bone in its normal position.

a previous diagnosis been made or treatment applied, and nearly all were referred by a physician or brought by the parents on the supposition that they were suffering from hip disease. It will be noted that the accidents were of such a nature as might cause fracture and that the symptoms and appearances were those of fracture; moreover, the diagnosis, which was in 1890 to be made only by a process of exclusion, can now be demonstrated by the accompanying skiagrams of two of the patients. As was stated in my former paper, fracture of the neck of the femur is, or was at that time, practically unrecognized as a possible accident of childhood, nor is the subject now considered in text-books as distinct from that of the adult or aged person. It would seem, then, that the subject deserves further attention, and especially since the symptoms and effects of the fracture differ very materially with the age of the patient. From this standpoint the following divisions of the subject are of especial interest:

1. The immediate diagnosis of the fracture.
2. The differential diagnosis from hip disease during the stage of recovery.
3. The question of fracture *versus* epiphyseal separation.
4. The immediate and remote effects of the fracture.

As regards the immediate diagnosis, it would seem that the evidence of injury about the hip, the elevation and projection of the trochanter, the change in contour, the shortening and eversion of the leg, would have made the diagnosis clear had accurate measurements been employed; but, on the other hand, it would appear, from the fact that several of the patients were able to walk in a few days after the accident, that the injury was a bending and breaking of the neck, a green-stick or impacted fracture, rather than an actual separation, so that in the absence of the peculiar helplessness and evident shortening of the limb the injury might have been overlooked by one familiar only with the described and accepted type of symptoms.

This simply emphasizes the fact that, in childhood, a careful physical examination is the only reliable evidence of the presence or absence of disease or injury.

If a primary diagnosis had not been made, one can well understand how the subsequent limp, the pain referred to the hip and

knee, and the pain and restriction of motion at the seat of the injury, might be mistaken, as in these cases, for the symptoms of disease, and yet the essential differences between the two should be sufficiently evident.

In all these cases the patients were perfectly well until they received a severe injury which necessitated immediate confinement to bed for several days or weeks. This in no sense corresponds to the slow and irregular onset of tuberculous disease. In from three weeks to six months after this primary disability, of which the symptoms had become less rather than more marked, the physical examination made evident a change in the contour of the body on the affected side, caused by the elevation and prominence of the trochanter, a shortening of the leg, and usually eversion of the foot. Such signs as the result of disease are evidence of an advanced stage, of upward enlargement of the acetabulum or of partial destruction of the neck of the bone, conditions that would be accompanied inevitably by the evidence of local disease, by restriction of motion and deformity of the limb.

In fracture such signs are absent. During the early stages of repair, of weakness and pain, motion is somewhat restrained by muscular spasm and by the voluntary effort of the patient, but this restraint does not, as in tuberculous disease, affect every motion in equal degree; it is particularly marked in flexion, abduction, and inward rotation, corresponding to the direct effect of the depression and backward displacement of the neck of the bone. In fact, it would appear that mistakes are due rather to neglect of proper examination or to inaccuracy in the interpretation of obvious signs than to any particular difficulty that diagnosis offers, either in the primary or the secondary stage of the injury.

The third point for consideration is of interest rather from the standpoint of accuracy than of practical importance. This is a question as to whether a fracture of the neck of the femur or a separation of the head of the bone at the epiphyseal junction is the more probable diagnosis after injury presenting such physical signs as have been described; for, although fracture has received no particular consideration, a number of traditional cases of separation of the epiphysis are recorded in the text-books.

It would seem, in fact, to be the general impression that an

epiphyseal junction is a weak point in the bone, and that the epiphysis may be easily jarred or otherwise separated from the shaft, so that a slight injury followed by deformity or weakness at the hip-joint, and particularly if these symptoms be slight, are considered as arguments in favor of epiphyseal disjunction rather than fracture.

There is no reliable evidence to support this assumption, either in regard to the upper extremity of the femur or to any other bone. The true epiphyseal separations, as verified by operation or autopsy, or when produced experimentally, have been the result not of slight but of extreme violence, by which the periosteum was stripped from the shaft of the bone and in which reposition of the fragments was extremely difficult. Such separations most often occur in those situations in which effective leverage may be applied directly to the epiphysis by means of its projecting processes to which the ligaments and muscles are attached, as at the lower extremity of the femur and humerus. Of all the epiphyses of the body that of the head of the femur is least liable to such leverage, and great violence would be much more likely to fracture the neck or to dislocate the femur than to cause a separation at the epiphyseal junction, which is the widest and strongest and best protected part of the bone.

In Bruns's[1] list of 100 epiphyseal separations, but one is recorded at this situation. This occurred in a girl, fourteen years of age, who was run over by a heavy carriage; the muscles about the joint were reduced to a pulp, the pelvic bones were fractured, and death followed soon after.[2]

Nor does the physical examination of the patients here recorded make such a diagnosis probable or even possible. In all the shortening of the limb was from half an inch to an inch, and yet the movements of the joint within the unrestricted range of motion were free and regular, and in all the union of the fragments was firm. If, however, this upward displacement of the trochanter had been the result of a separation of the epiphysis, which forms the greater part of the articulating surface, the great irregularity within the joint, at the point of repair, would have

[1] Archiv für klinische Chirurgie, vol. xxvii. p. 241.
[2] Bousueau: Bulletin de la Société anatomique de Paris, April, 1867, p. 283.

caused restriction of motion to a much greater degree than was present in any one of these patients.

Epiphyseal separation at the hip-joint as the result of acute suppurative disease is not at all uncommon in early childhood, the resulting upward dislocation being often mistaken at a later period for congenital misplacement of the femur, and it is such a displacement, the result of non-union of the fragments, that would almost inevitably follow a traumatic separation to the extent indicated by three-fourths of an inch of shortening of the leg. (Figs. 1, 2, 3, and 4.)

As these patients were not seen by me at the time of the accident I cannot report upon the relative results of treatment. Indeed, it is very doubtful if better immediate results could have been obtained by the usual procedures than those which followed no treatment.

It would appear that there is practically no danger of non-union, and, as has been stated, it is probable that the fragments are not usually separated. In some instances in which the shortening is slight and the trochanter not prominent there is probably a true impaction, in others the neck of the bone is simply depressed downward and backward. It is upon this change that the immediate shortening and the danger of future disability depend, and on this account the advisability of breaking up a partial impaction when elevation and prominence of the trochanter are present should be considered.

This might best be accomplished by abducting the leg to its full limit, thus by leverage of the rim of the acetabulum and by downward pressure on the trochanter, with extension of the limb, one might hope to rectify the deformity, at least in part. If this were possible, a plaster bandage, extending from the axilla to the toes, applied under extension in the abducted attitude, might secure union in this selected position. If the fragments were actually separated, a long Thomas hip-splint, so modified as to allow for direct traction and counter-traction by means of a perineal band and leg-straps, might be used with advantage. At the stage of repair in which I have seen these patients the indications for treatment were very simple, since it was evident that the injured limb was incompetent to sustain the strain of use, and for those patients who remained under treatment the simple traction hip-splint, or one of

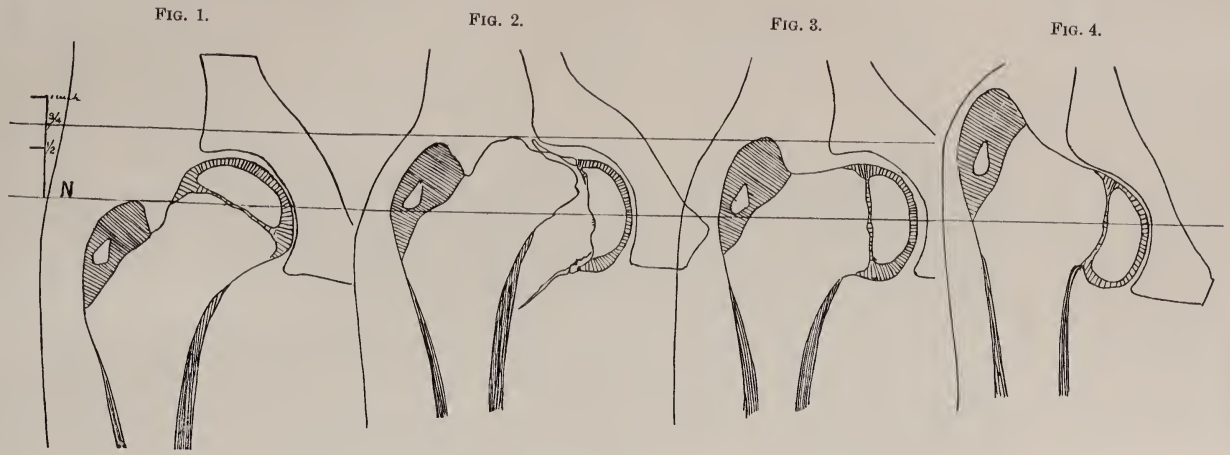


FIG 1. The upper extremity of the femur, exact size at the age of five years, drawn from a specimen in the Museum of the Hospital for Ruptured and Crippled, showing the epiphysis of the head and trochanter and the relation of the trochanter to Nélaton's line, N. The shaded area in the head and trochanter represents the cartilage.

FIG. 2. A scheme to illustrate epiphyseal disjunction, showing the separation of fragments necessary to account for upward displacement of the trochanter to the extent of three-fourths of an inch, as in the cases reported.

FIG. 3. A scheme to illustrate fracture and depression of the neck of the femur and consequent elevation of the trochanter, also the limitation of the range of abduction of the limb that must result.

FIG. 4. A scheme to illustrate further depression of the neck and its effect in causing permanent abduction of the thigh.

its modified forms, was applied; this was worn for several months, and it at once relieved the symptoms. I again suggest that its more frequent use as a walking splint would shorten very decidedly the period of helplessness and discomfort after the similar injury of the adult. With it massage and passive motion, particularly in the direction of abduction, should be employed to guard against the permanent adduction of the limb, a deformity that sometimes follows fracture due, doubtless, in part to the improper use of the leg during the prolonged weakness of convalescence.

As to the remote results of the accident, the great danger to be apprehended is the increased shortening and disability, due to a further descent of the depressed neck of the femur, even though it may be deferred to the period of adolescence.

It is the normal upward inclination of the neck of the bone, to about 129° in childhood, that protects it from strain. When it is depressed, as the result of violence or otherwise, the tendency to a further descent until the head of the bone rests upon the trochanter minor is very great.

This fact is emphasized by the history of Case I., now fifteen years of age. At the time of the injury and when treatment was discontinued the shortening was but three-fourths of an inch, and there was no disability. Two and a half years later the shortening was one inch with slight limitation of the range of abduction. At the present time (February 5, 1897), at the age of fifteen, he presents the typical appearances of extreme coxa-vara. (Figs. 5 and 6.)

There are atrophy of the limb and eversion of the foot, two and a quarter inches of actual shortening, which is increased two and three-fourths inches by the permanent adduction of the thigh. The patient walks on the toes of the short leg with a marked limp. The shortening is not the result of interference with the growth of the limb, since the distance from the trochanters to the malleoli is equal on the two sides; it is due to the depression of the neck of the bone and to the corresponding elevation of the shaft on the pelvis.

The condition of I. is duplicated by that of IV., who has also reached adolescence. He was examined February 18, 1897, four years after treatment had been discontinued. There is now an actual shortening of two inches, increased to two and a half inches

by a permanent adduction of the thigh. The other signs are so similar to those of the preceding case that it is unnecessary to enumerate them. In this case there are at times symptoms of discomfort about the joint and thigh after long standing or exertion, similar to those of the ordinary coxa-vara.[1]

Fig. 5.

Photograph of patient No. 1, illustrating a remote result after fracture—atrophy, adduction, eversion, and shortening; also a secondary knock-knee.

The same increase of deformity is illustrated by the present condition of Case V. This child, at the age of two and a half years, sustained a fracture with shortening of three-fourths of an inch. One year later there was no disability and no increase of the short-

[1] Whitman: "Observations on Bending of the Neck of the Femur in Adolescence," etc., New York Medical Journal, June 23, 1894.

ening. Now, at the age of seven years, the shortening has increased to one and a quarter inches, there is well-marked restriction of abduction, and it is evident that there has been a gradual depression

Fig. 6.

Patient No. 1, showing the great projection and elevation of the trochanter, made more apparent by flexing the leg.

of the neck during the three and a half years since the last examination. (Figs. 7 and 8, and skiagram No. 5.)

The skiagram of one of the more recent patients (Case VIII.) shows the position of the neck after fracture and the strain to

which it must be subjected—a strain that must almost inevitably lead to greater depression.[1]

It is this danger of future, if long-deferred, deformity as the result of this fracture in childhood that has led me to advise what

Fig. 7.

Photograph of patient No. 5, four years after the accident, showing the shortening and eversion of the leg. *Vide* Skiagram No. 1.

would hardly be indicated at a later period of life, the attempt to rectify the deformity by forcible manipulation.

[1] Of the remaining cases, one has been under observation but a short time (Case X). Two were not again seen after the original treatment or examination (Cases III. and VII). In Case II. the shortening increased a half inch in one year; Case VI. a quarter of an inch in two and a half years; Case VIII. a quarter of an inch in fifteen months. In but one case (Case IX.), examined fifteen months later, had there been no increase in the shortening.

The history of the cases here presented would seem to show that final disability does not depend upon the direct injury to the bone at the time of the accident or upon a subsequent loss of growth. It is due almost entirely to the distortion of the neck of the femur and to the interference with the function of the limb that this depression entails.

Fig. 8.

Rear view of the same patient (No. 5), showing the prominence of the trochanter on flexing the leg, as in patient No. 1.

The determining causes of the deformity and ultimate disability are:

1. The direct result of the injury. This might be remedied, in part at least, by the treatment suggested if the patient were seen at the time of the accident.

2. The further depression due to the early use of the limb during the stages of repair. This might be prevented by the application of a hip-splint or perineal crutch, which should be worn for at least six months, or until complete consolidation had taken place. The support should be combined with daily massage and forcible manipulation of the limb in the direction opposed to its limitation —that is, in abduction—to prevent secondary changes in the muscles, which increase the disability.

FIG. 9.

Photograph of patient No. 8, illustrating the tilting of the pelvis toward the short leg. The relative size of Bryant's triangles is shown in the background. *Vide* Skiagram No. 2.

3. The later sinking of the neck, due simply to the strain to which it is exposed by the deformity. This may be prevented, if at all, only by the supervision of the patient, who must avoid violent exercise, and particularly long standing or laborious occupation. It is evident, also, that a guarded prognosis as to the final outcome of the injury should be made when treatment is begun. The treatment of the final disability should be similar to that of

the ordinary form of coxa-vara—that is, by a division of the neck of the bone or by a subtrochanteric osteotomy—although the duration of the deformity and its causes is likely to make the result of the operation much less favorable than in the latter instance. It should be remembered that in childhood a shortening of even half an inch will cause tilting of the pelvis, so that a higher heel should be worn to prevent a compensatory deviation of the spine.

In conclusion, it may be stated that the principle object of this paper is to demonstrate again that the traditional age-limit for fracture of the neck of the femur, that may have led to inaccuracy of teaching and to errors in diagnosis, does not exist.

The evidence presented would seem to prove that the fracture not only does occur in childhood, but that it is probably not an uncommon accident. It may be unrecognized, or it may, at a later period, be mistaken for and treated on the diagnosis of hip disease.

Separation of the epiphysis of the head of the bone is doubtless a possibility, but one may conclude, in opposition to the accepted teaching, that it would be rather extreme violence, followed later by non-union of fragments or by marked interference with the functions of the joint, that would favor this diagnosis, while the less violence and the less the immediate disability the greater the probability of fracture, when signs of fracture are present, because a bone is more likely to break in its weakest than in its strongest part, and because rapid repair and almost normal functional ability while upward displacement of the trochanter remains, as in the cases here reported, shows that the break could not have involved the articulating surface of the joint.

Finally, attention is again called to the peculiarity of this fracture of childhood, that although the immediate results are extremely favorable without treatment, yet the final outcome is likely to be a disability even more noticeable than after fracture in adult life.

A NEW MODIFICATION OF THE HIP-SPLINT.

By JOHN DANE, M.D.,
BOSTON.

The groundwork for the splint shown in the accompanying picture is what has long been known as the "Thomas knee-splint." To this has been added a Burrell screw extension, by which it can be somewhat lengthened as occasion may demand. At the bottom there is a windlass and cogwheel, whereby traction can be made upon the ends of a plaster extension applied to the leg. At the top it is fitted with a pelvic band similar to that now used upon the Taylor hip-splints; but so adjusted by means of a hinge-joint that it can be carried sideways when the splint is being put on, and then locked into position by a simple key. The rather broad leathers are sewed to the outside upright, and go thence around the leg and inside upright as well, lacing up in the front. The upper one is worn as high as possible, the top of the lower one should come just below the patella. The perineal strap, when one is necessary), is made of linked window chain, padded with felting and covered with canton-flannel. This is riveted to the splint behind, and fastened in front by being slipped over a hook. When the proper length has been found, all superfluous links of the chain are cut off.

The advantages claimed for the new splint are:

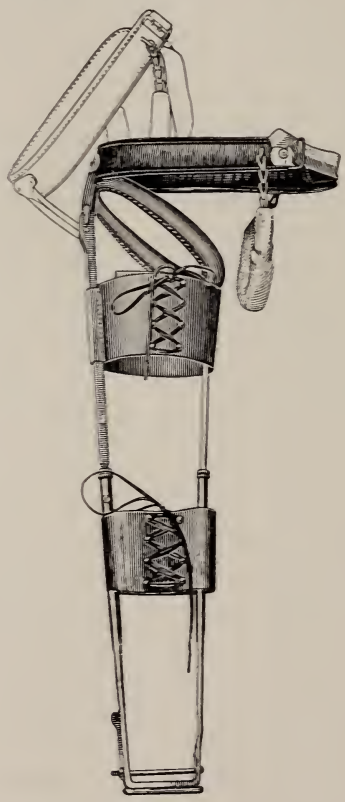
1. That while it is as easy to adjust upon a sensitive hip as the common form with two detachable perineal bands, it is more firm when in place.

2. That it cannot be put on wrongly nor worn too high up, as one so frequently finds the splints which depend for their position upon the length of two adjustable perineal bands.

3. By replacing the counter-pressure of the yielding perineal

straps upon the soft tissues of the groin with that of a rigid metal ring pressing against the tuberosity of the ischium, a firm point of resistance is substituted for a yielding one, and danger from cutting and chafing much reduced.

4. It is impossible for ignorant parents in out-patient clinics to apply the traction first, and then try and tighten the perineal straps afterward; the counter-pressure is here the first point established.



5. It is impossible for a child to loosen the perineal straps and so avoid an uncomfortable amount of traction during the night.

6. By making the movable perineal strap (where one is necessary) of metal chain, and cutting it to the desired length, it obtains an unyielding and yet flexible means of support and one that cannot be worn too loose.

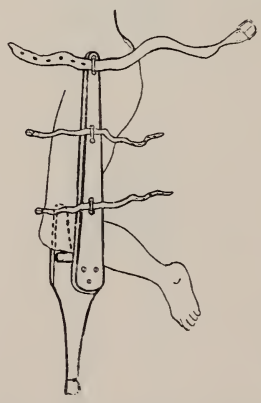
7. By means of the broad leathers, passing around both uprights, the leg is held more firmly in the correct position with less constriction than in the common splint with a single upright, and the tendency to genu-valgum or subluxation of the tibia is greatly lessened.

8. When used for a walking or convalescent splint, the windlass attachment can be cut off. The round ends of the upright are then bent at right angles with the shaft for the last half inch or so, and can be slipped into either end of a small piece of tubing fastened to the heel of the shoe. If the length of the upright has been so fixed that the heel of the foot does not quite come into contact with the heel of the shoe, the weight of the body will, when standing, be supported about equally by each of the uprights of the splint. As a consequence, in walking, the customary unpleasant sideways lurch, due to the necessity of bringing the centre of weight over the single outside upright of the ordinary splint, is in a great measure done away with.

A NOTE ON THE USE OF THE PEG-LEG IN THE TREATMENT OF DISEASE OF THE ANKLE OR TARSUS.

By JOHN C. SCHAPPS, M.D.,
PUEBLO, COLORADO.

In examining recently a case of tarsal disease I was impressed by the simple and efficient means of protection which the patient, Michael Sabbo, had adopted. It was the old-fashioned peg-leg, thus for the first time, I believe, employed as an orthopedic apparatus. The patient was able to perform the duties of a fireman



The peg-leg used in a case of tarsal disease.

without injury to the diseased foot. In cases of disease of the ankle or tarsus this instrument will accomplish the following purposes:

1. Protection against pressure of weight. 2. Relaxation of calf-muscles. The foot can therefore be kept at or nearly at a right angle with the leg without causing interosseous pressure. 3. Diminution of the ill-effects of pendancy.

It also permits the application of plaster-of-Paris or other means of fixation.

The peg-leg, as shown in the cut, consists of a conical block, upon whose base the patient's weight is received, and two side strips or slats secured by screws to the block. Or it may be cut from a single piece of hard wood. The block is cushioned on top, and ends below in a peg which should be ferruled. The outer strip extends nearly to the crest of the ilium, the inner to just above the condyle. The apparatus is secured by straps, one around the pelvis and two around the limb.

A STUDY OF MEASUREMENTS IN CURVATURE OF THE SPINE.

By G. W. FITZ, M.D.,
CAMBRIDGE.

During the past six years measurements and strength-tests[1] have been made upon curvature cases in the Out-patient Department of the Boston Children's Hospital to determine the factors instrumental in the production of curvatures of the spine.

The strength-tests taken are as follows—of the back, of the right and left side, and of the muscles moving the arms in the cardinal directions. The purpose was to measure the strength of the trunk muscles which had influence upon the postures of the spine, shoulders and arms, and to determine whether any unilateral weakness existed which could account for the curves. Cases in which the curvature was secondary to a paralysis have not been included in this study. In paralytic curvature there is weakness of the convex side, but in some paralytic cases there is marked asymmetry of strength without coincident curvature.

The back strength was taken with the back well bent and the legs straight by means of an ordinary dynamometer fastened to the floor. For the reason that varying age and gymnastic training produce great inequality in its value, it has not been included in this study; only those bilateral tests have been included which check each other regardess of the total strength of the individual.

The side strength was tested by the same dynamometer, and measured the ability of the individual to pull up with one hand, the body being bent sidewise and legs straight.

The tests named deltoid, scapular, latissimus dorsi, and pectoral measured the pull made by the arms extended laterally at right

[1] These observations are reported through the courtesy of Dr. E. G. Brackett, who has charge of the curvature clinic.

angles to the body in the general direction of these muscles. In each case the feet were placed widely apart to give full support, and in most cases several tests were made and the maximum recorded. In order to get a satisfactory test of the forward and back pull (pectoral and scapular) and to avoid the slipping of the feet upon the floor, it was found necessary for the operator to press upon the back of the shoulder for the pectoral test, and upon the front for the scapular. This tended to localize the effort in the muscles immediately about the shoulder. Undoubtedly a better way to test the trunk-muscles would be to fix the pelvis firmly and to allow the subject to make the effort unassisted; it was found difficult, however, to arrange the necessary apparatus, and the other test was fairly satisfactory.

TABLE.—AVERAGE STRENGTH-TESTS (in lbs.) IN RELATION TO CHARACTER OF CURVE.

	Side.		Deltoid.		Scapular.		Lat. Dorsi.		Pectoral.	
	Right	Left	Right	Left	Right	Left	Right	Left	Right	Left
Right dorsal . . .	53.9	53.0	8.4	8.1	8.2	8.0	11.6	11.1	8.4	8.6
(No. observations) . .	(22)	(22)	(41)	(41)	(40)	(40)	(41)	(41)	(41)	(41)
Left dorsal	53.0	49.0	8.3	7.6	7.7	7.3	10.4	10.2	7.6	7.7
(No. observations) . .	(12)	(12)	(21)	(21)	(21)	(21)	(21)	(21)	(21)	(21)
Round shoulders . .	45.3	44.9	6.6	6.5	7.3	6.7	9.0	8.8	6.9	6.2
(No. observations) . .	(13)	(13)	(33)	(33)	(33)	(33)	(33)	(33)	(33)	(33)
Miscellaneous . . .	55.7	51.3	7.4	7.4	7.1	6.5	9.4	9.1	7.3	7.1
(No. observations) . .	(20)	(20)	(29)	(29)	(29)	(29)	(29)	(29)	(29)	(29)

It will be seen by reference to the table that the curvature cases are divided into two groups, with right and left dorsal convexity respectively. A preliminary examination of the records failed to show evidence of consistent unilateral variation in strength. It was thought that a combination of all the observations would bring out in the averages any latent inequality of strength; therefore in the table are given the average lateral strengths for the number of observations indicated. These averages were obtained by adding together all the strength-tests for each group of individuals and by dividing the resultant sums by the number in the group. A comparison of the numbers so obtained shows remarkable equality

in strength between the two sides and suggests that there is no unilateral weakness to account for the curves. It will be noticed that there is a slight superiority of the right over the left in all the groups.

CONCLUSIONS.

(1) The cases of right dorsal curvature show no evidence of unilateral weakness.

(2) The cases of left dorsal curvature also show no evidence of unilateral weakness.

(3) The cases of round shoulders show similar equality between the strength of the two sides.

(4) The miscellaneous cases, including wry-neck and other deformities, show bilateral equality in the strength of trunk-muscles.

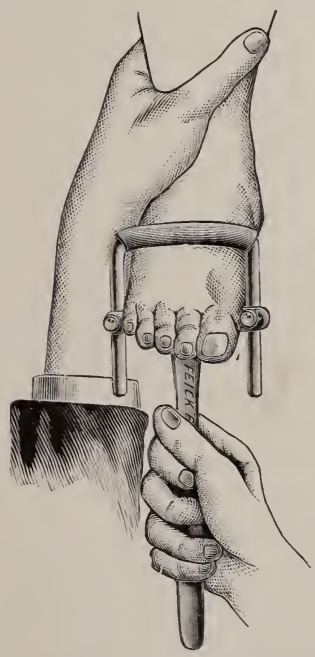
These cases of spinal curvature suggest that unilateral muscular weakness does not enter as an etiological factor in idiopathic curvature of the spine.

It may be added that in nearly all the cases of curvature studied, a detailed history of deforming posture in sitting, standing, or more especially sleeping, was obtained which seems to suggest an essential etiology of the trouble.

A NEW CLUB-FOOT WRENCH.

By STEWART L. McCURDY, M.D.,
PITTSBURG, PA.

In the treatment of the various forms of talipes, after tenotomy of the tendo-Achilles, or the plantar fascia, or of other muscles and ligaments, or after such other operations as the individual case may require, great force is frequently necessary to break up the



adhesions and rupture the abnormally short tendons which may be found between the bones. These abnormal relationships must be disturbed. The hands of the surgeon are not always sufficiently powerful to bring the foot into a normal position. It may be

necessary to even fracture the bones to overcome the deformity. The "T. T." or "Thomas Twister" is not entirely satisfactory as a club-foot wrench. The Phelps appliance is all powerful, but is quite complicated, expensive, and cumbersome, and neither of these appliances can be kept absolutely clean. The wrench herewith illustrated is simple, can be kept aseptic, and is not expensive. While the handle is to one side of the foot in the "T. T.," the handle is in the centre of this twister, and there is great advantage given the operator in power, and there is less danger of the wrench slipping around the foot. The set-screws shown allow an adjustment to any foot. The bars as they come in contact with the skin are protected with rubber tubing. When it is desirable to forcibly correct the tibio-tarsal joint, the foot is passed entirely through the aperture in the wrench, or the wrench may be taken apart and adjusted around the ankle. The distal bar rests above the malleolus on one side, and the proximal bar against the tarsal bones below the malleolus on the opposite side.

THE OPERATIVE TREATMENT OF LUMBAR POTT'S DISEASE.

By JAMES K. YOUNG, M.D.,
PHILADELPHIA.

In the Transactions for 1891 I reported a case of external lumbar abscess and suggested a division of the lumbar abscesses into external and internal, according to their location, external or internal to the lumbar fascia. During the past fourteen years a large number of cases of lumbar abscess have come under my observation; a few of them of small size have been absorbed under conservative treatment, but a majority of the cases required operative interference of some kind. Where the abscess is small and the contents not very thick, aspiration with or without the use of antiseptic injections is often followed by the disappearance of the abscess. This is particularly true of external lumbar abscess. Where the contents are thick and consist of caseating material, incision and free drainage under aseptic precautions will be the only plan of treatment likely to be followed by success. The incision must be made at the most favorable point for drainage, and where it is possible through-and-through drainage by means of a rubber drainage-tube or iodoform-gauze will be the best plan surgically to follow in these cases. Where repeated aspirations fail, or for other surgical reasons they do not seem to be indicated, incision and drainage will be necessary. Aspiration has seemed to me to be unsatisfactory and tentative on account of non-withdrawal of caseous clots, except in the cases above indicated. The injection of carbolic acid solutions has not been employed, because of the reported fatal cases; and early radical operations, especially erosion of the vertebra, has not been employed, because of the high mortality.

Dr. Rupprecht, of Dresden, informed me, nine years ago, that

after a fair trial he had abandoned the radical operation, because 50 per cent. had died from the operation.

The incision will vary with the form of abscess, and the position of the cicatrices will sufficiently indicate the position in the different forms.

The different forms of abscesses are well shown in the table of spinal abscesses which appears below:

TABLE OF LUMBAR ABSCESSES.

Course.	*Exit.*
a. External Lumbar Abscesses.	
Burrow between the fasciæ of the quadratus, lumborum, and abdominal muscles through the internal oblique.	Particularly beneath the external oblique and latissimus dorsi at the outer border of the erector spinæ muscle.
b. Internal Lumbar Abscesses.	
1. Enter psoas sheath.	As psoas abscess.
2. Gravitate beneath the internal iliac muscles over the posterior brim of the pelvis, perforating the great sacro-sciatic foramen.	As gluteal abscess or as iliac abscess.
3. May be directed to the iliac region along the aorta and external iliac arteries.	As gluteal abscess.

In 1894 I showed two cases of iliac lumbar abscess, and referred to a third before the Philadelphia County Medical Society,[1] all of which had recovered after through-and-through drainage. The abscesses in these were large, and the result has been most gratifying. The operation advocated in these cases is performed under strict aseptic precautions. The abscess is opened by careful dissection. The incision is made in the direction of Poupart's ligament, half an inch to the inner side of the anterior-superior spinous process. The external oblique muscle is divided in the direction of its fibres. The internal oblique muscle is divided at right angles to the direction of its fibres, or the fibres are separated. The contents of the sac are evacuated, and a long, heavy-grooved director or eyed probe is passed carefully up to a point above the sacro-iliac junction, and a straight, longitudinal incision made upon it. The counter incision in two of these cases was half an inch to the outer side, above the posterior-superior spinous process of the ilium. In one case in which I was associated with Dr. Willard and Dr. Ashhurst it was consid-

[1] Transactions Philadelphia County Medical Society, 1894.

Fig. 1.

Internal lumbar abscess, showing primary and counter incisions.

Fig. 2.

Lumbar caries, showing position of cicatrix.

Fig. 3.

A case of bilateral lumbar abscess, showing posterior deformity and lateral sinuses.

Fig. 4.

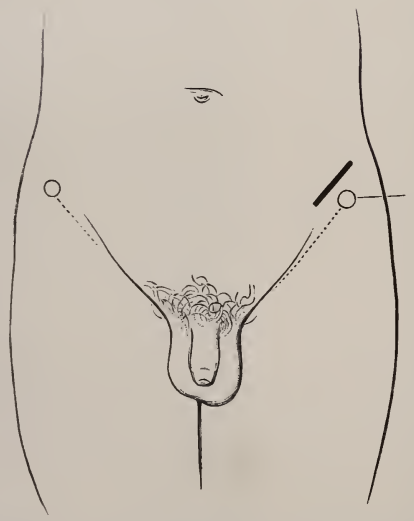


Diagram illustrating position of incision in a case of lumbar abscess.

Fig. 5.

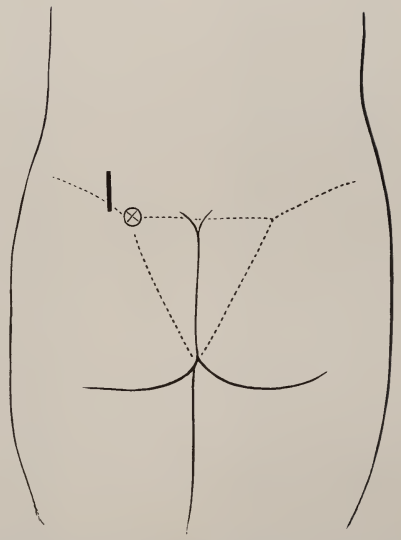


Diagram illustrating position of the counter incision in a case of lumbar abscess.

ered advisable to either trephine the upper part of the crest of the ilium or remove a portion with a rongeur forceps, so as to permit the drainage-tube to lie flat in the iliac fossa. The latter was done, and appeared to facilitate the drainage and healing of the abscesses rather than retard them. The abscess-cavity is thoroughly irrigated with boiled water and boric-acid solution. A rubber drainage-tube is passed through and secured with safety-pins. This is allowed to remain in for two or three days, after which it is divided and gradually shortened. Emulsion of iodoform (10 per cent.), half a drachm, is thrown in, iodoform-gauze packed about the wound, and a bichloride dressing applied.

The indications for this operation are:

1. Where the abscess is large and making pressure upon important organs.

2. Where the abscess is increasing rapidly in size.

3. Where there is danger of rupture of the abscess into the peritoneal cavity.

In psoas and gluteal abscess it is rarely possible to make a counter-opening and to accomplish through-and-through drainage. After incision and drainage a rubber drainage-tube should be inserted into the abscess as far as possible, and the abscess-cavity irrigated daily or every other day with boiled water and boric acid solution, followed by the use of iodoform emulsion.

In all cases requiring operation it is absolutely necessary to fix the spine as thoroughly as possible by apparatus of some kind. In one of these cases the iliac lumbar abscess in an adult female under the care of another surgeon the abscess sinus would not close until the spine was thus secured.

THE DIRECT TRANSPLANTATION OF MUSCLES IN THE TREATMENT OF PARALYTIC DEFORMITIES.

By JOEL E. GOLDTHWAIT, M.D.,
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The fact that the tendons of non-paralyzed muscles can be attached to the tendons of those which are paralyzed, with a marked improvement in the usefulness of the part as well as correcting or diminishing existing deformities, has been definitely proved. During the past three years, since careful attention has been given to the subject, quite a large number of cases have been treated by different surgeons with very generally good results. Personally, of the thirty cases which have come under my care, the improvement, with one or two exceptions, has been very decided.

Until a year and a half ago these operations had been confined entirely to the reattachment of muscles which had distinct and well-formed tendons; but as the results in these cases were so gratifying it was natural to try the same principle in other parts in which the mechanical conditions were similar, although the anatomical structures were unlike. It was found in a large number of cases of infantile paralysis, in which the thighs were involved, that the sartorius and the tensor vaginæ femoris frequently escaped the otherwise general paralysis. The latter, because of its small size and the limited range of its contractility, is of comparatively little importance either in producing or for use in correcting deformities. The former, however, is different; naturally a long and strong muscle, with its spiral position, and the fact that between its distal and proximal attachments are two large joints, it is evident that, if not properly antagonized, it can produce undesirable results. The outward rotation of the leg, together with

the flinging gait so often seen in infantile paralysis, is largely the result of the action of this muscle. The ilio psoas, and some of the deep rotators, do, of course, play a part; but from the better attachment, mechanically, the sartorius is undoubtedly the most important.

Normally, when the other muscles of the thigh are present, the sartorius by its contraction causes flexion, abduction, and outward rotation of the thigh and also to a limited degree extension of the knee. In its normal position, resting as it does upon the strong anterior group of thigh muscles, it (the sartorius) in the middle of the thigh is raised at least an inch from the femur, so that in its contraction the quadriceps acts as the fulcrum over which the power of the sartorius is applied. It is this position or elevation of the sartorius upon the quadriceps that makes it possible for it to act as an extensor of the knee.

When, however, the muscles are affected as they are in poliomyelitis (acute anterior) the mechanical conditions change. The quadriceps extensor, instead of being an inch or more thick, becomes so much atrophied that it is represented by a thin fascia. The sartorius, as the result of this, practically rests upon the femur, and in changing its position it not only sinks down against the bone, but is drawn further backward on the inner side, so that as the result it crosses the femur nearer the upper part of the thigh than is normal.

In the new position, together with the absence of the muscles which normally antagonize it, the sartorius by its contraction causes an increase in the normal amount of flexion, abduction, and outward rotation of the thigh, and at the knee, instead of causing extension, it becomes a flexor. This can readily be demonstrated by having the patient sit upon a table so that the legs from the knees hang freely. Upon contraction of the sartorius, with the flexion and rotation of the thigh, which is expected, the foot and leg are drawn backward, not forward, this being the most conspicuous part of the movement.

It is obvious from this that with the muscle so situated its presence is in part a disadvantage, and as far as the control of the knee is concerned it would have been better had it been involved in the otherwise general paralysis.

About two years ago I described an operation at a meeting of the Boston Orthopedic Club, and later showed a patient at the Surgical Section of the Suffolk District Medical Society in Boston, in which the sartorius muscle was transplanted and attached to the quadriceps extensor just above the patella. When the operation was first planned it was with the hope that by giving this muscle, which normally possesses considerable strength, a better mechanical attachment, the undesirable deformity would be corrected and the usefulness of the leg increased.

Since that time I have operated upon five patients for this purpose. In three the result has been a marked improvement; in two the result was a disappointment, the failure probably being due to imperfect methods of attaching the muscles. With the more perfect technique and with greater experience such failures should not result.

Of the three successful cases, one, a grown woman twenty years of age, has at the present time absolutely the normal amount of extension of the leg at the knee as contrasted with an entire inability to extend the leg before the operation. When sitting she is able to straighten one leg and hold it straight (thus supporting all of the weight of the leg) quite as well as the other. Upon standing, at the present time, the patient is able to bear all of the weight of the body on the lame leg, without artificial support, the sartorius being strong enough in its new position to hold the joint stiff. Before the operation, there being no power in the extensors of the thigh, no weight could be borne upon the leg unless the knee was fixed in a brace or supported by some artificial means. The flail, flinging gait, which was the only possible method of locomotion, has been entirely corrected, the leg being extended normally when the step is taken. The patient is, of course, still somewhat lame, but the lameness is due chiefly to the weakness of the foot and ankle, the mechanical difficulty at the thigh having been almost entirely corrected. No apparatus for the thigh is now necessary, and the patient has been employed doing regular housework for the past eight months. The paralysis in this case had existed since early childhood, and previous to the operation she had been dependent upon the constant use of a cane or crutch.

In the second of the three successful cases the result will, I

think, be quite as good as in the previous case. The patient, a boy, twelve years of age, was first seen in consultation with Dr. C. S. Millet, of Brockton, and at that time there was complete paralysis of all of the muscles below the right knee, and no power in any of the anterior thigh muscles, except the tensor vaginæ femoris and the sartorius. On sitting with the legs hanging, extension of the leg at the knee was impossible, as was also standing without support. On walking the thigh was rotated and the leg flung along.

When last seen, about five months after the operation, extension through almost the normal limit was possible. On sitting the leg could be straigthened completely, but the muscle was not strong enough to hold it fully extended for more than a moment. There has been such a steady improvement in his condition, however, that I feel sure the sartorius will strengthen enough to give quite as useful a leg as in the former case.

The flinging gait with the rotation of the leg has been entirely corrected.

The third case, a girl eight years of age, had infantile paralysis of the right leg. All of the anterior muscles of the lower leg were completely paralyzed, and the anterior thigh muscles were much weakened, although they responded somewhat to voluntary effort. There was not enough power in the quadriceps, however, to completely extend the leg when the child was sitting.

The operation was performed about one year ago, with the idea of using the sartorius to help the weakened quadriceps. The result in this case has been a very decided improvement, the gait is better and the extension of the leg is likewise improved.

This in some ways was a more favorable case, and the result is not so striking as in the two just reported.

The operation is shown in the illustration, and consists in making a longitudinal incision about six inches long on the inner side of the thigh, so that the middle of the incision is opposite the top of the patella. Through this the sartorius muscle is dissected out and cut off at the extreme lower end, where it is attached to the tibia (x). This is then brought forward and attached to the muscular fascia just above the patella and a little to the inner side. The attachment must be made very firmly, and to accomplish this the

fascia should be split and the muscle drawn through this so that it becomes adherent to both the outer and the inner surfaces. For sutures, kangaroo-tendon is by far the best material; catgut is not strong enough, and is absorbed too quickly, while silk cuts out (one failure apparently being due to this). The wound should be

completely closed, and the whole thigh tightly bandaged with a compress bandage, with the idea of preventing the contraction of the muscles so far as possible. Over this a plaster-of-Paris bandage or a long splint should be applied to control the motion of the knee-joint. The patient should be kept lying down for two weeks,

at least, all attempts at sitting or even raising on to the elbows being avoided, so as to relieve the strain upon the thighs. Gentle motion at the end of three weeks should be commenced, and the plaster entirely omitted at the end of from five to six weeks.

The course of these cases after the operation has been interesting. Theoretically, from the histological structure of the sartorius muscle (made up as it is of long, slender, parallel fibres), one would expect comparatively little increase in its normal strength or size; nevertheless, as the work has been increased, the strength of the muscle has increased also until it has been able to do quite perfectly the work of the quadriceps that would be required in walking or standing. In one case, in four months the circumference of the thigh, measured in two positions, increased one-half of an inch. This development or increase in strength has taken place, however, more slowly than would probably be the case in muscles with the fibres arranged differently.

About the time the operation was first described a similar operation was performed by Dr. Milliken, of New York City. This case has been reported together with a case in which an attempt was made to transplant a portion of the deltoid. Besides this, a case operated upon recently by Dr. F. B. Harrington, and another by Dr. G. C. Dolliver, at both of which operations I was able to be present, constitute, so far as I know, all the operations of this kind which have been performed. The results are most encouraging, and the improvement, especially in the first case here reported, has far surpassed my most sanguine hopes. The failures probably would not have occurred but for the newness of the operation and the lack of perfection of the details.

The only other attempt at the reattachment of the muscles directly which has been made by me personally, is a case of infantile paralysis of the leg, involving chiefly the anterior tibial muscle, and resulting in a marked valgus position of the foot.

In similar cases it has been found, in attaching the tendon of the peroneous tertius, or the tendons of the common extensor, to the anterior tibial, that the tendons were so small that, as the result of the suturing and necessary handling at the time of operation, sloughing frequently took place, and not only was the healing

delayed, but the ultimate result more or less impaired. In the endeavor to avoid this the following operation was performed:

Through a straight incision three inches long, made longitudinally over the middle of the exterior surface of the leg, the muscle of the common extensor was dissected out and approximated to the anterior tibial muscle, and the two attached by means of quilted sutures. The attachment was made at the lower portion of the muscle, so that a portion of the tendinous expansion was included in the sutures; by doing this none of the contractile fibres of the muscles were impaired.

The wound was then closed tightly, and the foot and leg treated with a plaster-of-Paris bandage, the same as when the tendons have been directly attached. In this way the danger of sloughing is eliminated, and the contraction of the common extensor muscle necessarily exerts some of its powers upon the inner side of the foot through the anterior tibial tendon. In this case there has been some improvement, although not as much as I had hoped, and the operation is reported as one of interest rather than as one which is wholly perfected or for which much is claimed.

In conclusion, it has been found in a large number of cases of infantile paralysis, in which the thighs are involved, that the sartorius and tensor vaginæ femoris are frequently unaffected when all of the other thigh muscles are destroyed. Without the other muscles which assist and antagonize the sartorius in its normal action, this muscle, from its peculiar position and attachment, produces undesirable results in the use of the leg.

To overcome this and to make the greatest possible use of the muscle, five cases have been operated upon by the writer and here reported, in which the sartorius was divided at its lowest attachment, and reattached to the aponeurosis of the quadriceps extensor above the patella.

The result in three of the cases has been a marked improvement — in one almost the normal usefulness of the leg resulting. Of the two cases of failure, both were probably due to the failure of the stitches to hold, so that the desired union was not obtained.

One case is reported in which the anterior tibial muscle and the common extensor of the toes were attached in the lower part of their muscular structures in order to correct the faulty position of the foot

A NEW BRACE AS AN ADJUNCT IN THE TREATMENT OF SEVERE CASES OF SCOLIOSIS.

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It is with some hesitancy that I present this subject to the American Orthopedic Association, knowing as I do the opposition which a few careful, experienced, and eminent orthopedic surgeons, notably Bernard Roth, of London, have expressed to the use of any supporting or correcting brace whatever in the treatment of lateral curvature of the spine.

I have, however, followed the teachings and clinical experience of many others, including our best American and German authorities, and can demonstrate with them the usefulness of a correcting and supporting brace as an adjuvant and reliable help to the other forms of treatment of this condition.

By the other forms of treatment I mean, first, the gymnastic treatment of symmetrical and asymmetrical movements for general muscular development and training, and for increasing the spinal flexibility, as first suggested by Ling and modified by Roth, the Sayres and Young, together with suspension; Wirt's swing; dumb-bells of moderate weight, pulley-weights, etc. Second, the forcible daily corrective treatment by means of such apparatus as that suggested by Hoffa, Schede, Bradford, Brackett, and Weigel, consisting of machines for suspension, overcoming lateral deviation, ligamentous and muscular contractions and rotation, all at the same time; together with the modified Lorenz "roller" and Zander "rocker," to increase backward and lateral flexibility of the spine.

I will at present deal only, in discussing my subject, with the mechanical treatment by means of braces; but in dismissing the other forms of treatment thus briefly I do not wish to be misun-

derstood that I do not use them; on the contrary, I do use them or some modification of them daily on every severe case under my care, and the brace simply as an adjuvant.

And, further, it seems to me that a brace can only be effectual

Fig. 1.

Posterior view of the brace.

on a case which has been rendered more or less flexible by exercises and forcible correction, if previously "fixed."

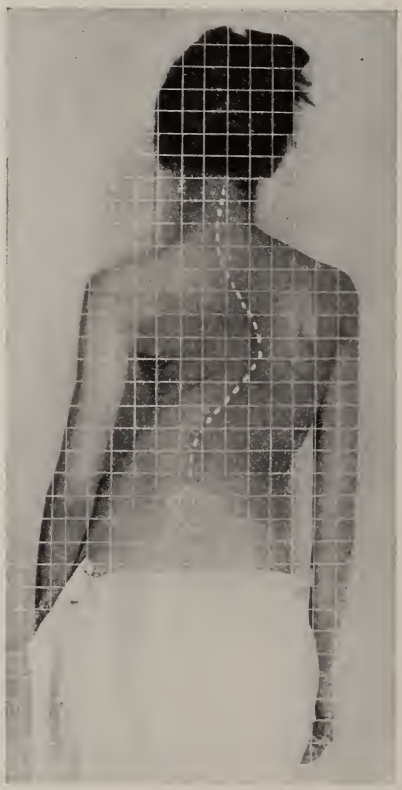
Fig. 2.

Anterior view of the brace.

In reviewing the literature of braces for lateral curvature I have found such an array of braces and such claims on the part

of the writers that I am forced to omit the consideration of the old forms of brace, which are so manifestly ill-adapted to meet the requirements of modern treatment from their failure to meet the requirements of the mechanical principles involved, their weight, complicated construction, and costliness, that I will simply consider a few of the more modern braces.

Fig. 3.



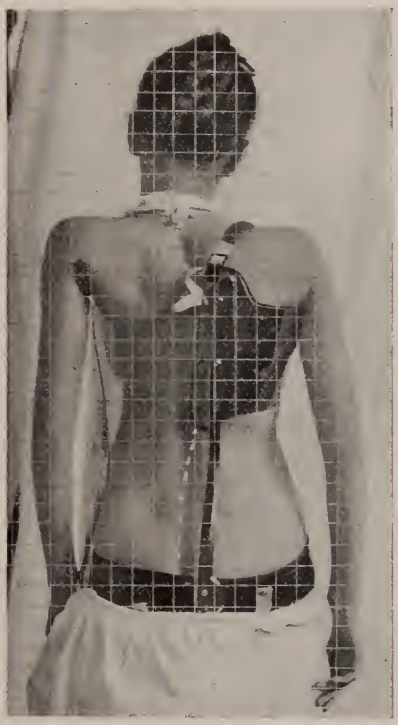
A patient, thirteen years old, at the beginning of treatment.

With the Shaffer brace, in the few cases that I have used it, I have not felt convinced that a sufficiently firm base of support or grip on the pelvis was obtained by the webbing straps that surround it, and the difficulty of fitting it perfectly, and its cost, ren-

dered its applicability limited to that class of cases which were in comfortable circumstances.

The heat of our Southern summers and the warmth of the removable plaster-of-Paris jacket, its limitation of muscular activity, and the necessity of applying a new jacket for every improvement in the curve have necessitated the employment of

Fig. 4.



The same patient with the brace applied after having been rendered "flexible."

this form of support in those of my own cases only where economy was an aim and in cases which seemed to have reached a point where little improvement can be effected and the chief object of treatment is to hold the cases and prevent their getting worse. In cases which are rapidly getting worse, and where we must apply some check at once, a plaster-jacket put on in suspen-

sion or on my plaster-jacket stool, or in recumbency, I have found useful as a temporary expedient.

Dr. Henry Ling Taylor's lateral-curvature brace seems very efficient, but rather complicated from the written description, and I have as yet not used it on any of my cases.

My main reliance for a retentive and corrective support to take up the gain effected by "forcible correction" had been, in all of my severer cases, the matrix paper and crinolin jacket suggested by Weigel and modified by Bradford, Brackett, and Bartow. It is made over a cast of the patient's trunk, which has been corrected —*i. e.*, so cut down on the convex sides of the curves and built up on the concave as to approach more nearly the contour of a normal body. But this method failed me, owing to the excessive perspiration produced by the intense heat of our Southern summers, which softened the jackets and rendered them useless, notwithstanding several coatings of shellac varnish, air-holes, and even reinforcements of thin steel strips.

The correction of the cast and the building up of the successive layers of the jacket require no small outlay of time and personal supervision on the surgeon's part, which is a further objection to this method.

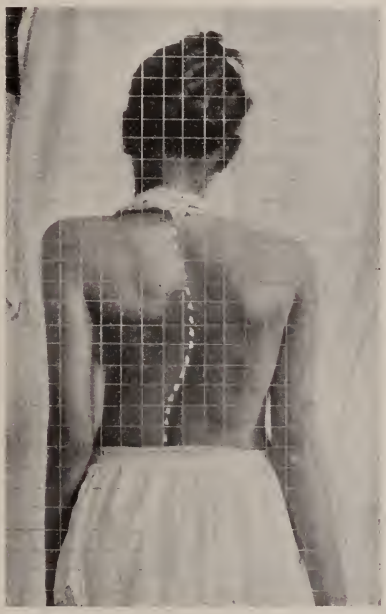
After a series of softened paper jackets had come to my office from several patients I had made the brace which I wish now to present to you. Its lightness, cheapness, simplicity, coolness, and adaptability to the changes in the shape of the thorax as improvement occurs, I trust, may commend it, and it has proved quite serviceable to me. I have used it chiefly for dorsal curves, but where lateral deviation has been more marked as a deformity, due to a lumbar curve, I have also found it helpful in overcoming this habitual malposition, which must ultimately lead to further osseous, muscular, and ligamentous changes.

My views in regard to these cases are that a case which assumes a faulty attitude will, notwithstanding daily drill in "posture and exercise" with forcible correction, make more rapid progress with a "reminder" and correcting force on, after she leaves the surgeon's office, than one without such support. No surgeon would hope to correct a severe case of bow-legs or knock-knees by daily manipulation and exercises without using some correcting appa-

ratus to be worn in the interim. These seem to me parallel cases.

The brace which I now present consists of a rigid steel band which encircles the pelvis at a point a finger's breadth below the crests of the ilia, with a hinge in the middle of the posterior portion and buckling tightly at a corresponding point in front. In order to make this band a fixed foundation for the desired force to act from, it is held in position by a perineal strap on either side.

Fig. 5.



The same patient after nine months' treatment.

At a point on the pelvic band below and corresponding to the region of most marked rotation and lateral curvature an upright is projected upward to a point corresponding to the apex of the curve. This upright is fastened to the pelvic band by means of two screws, the lower one being the centre of an arc through which the upright may be moved, and the upper screw may be inserted into any one of several adjacent holes in the pelvic band depending on the direction it is desired the upright should take.

At a point diagonally opposite to this posterior upright, corresponding to the region of the most marked anterior rotation of the ribs, is projected upward an anterior upright similarly attached to the pelvic band. Fastened at the top of the posterior upright, by means of a slot in the upright and screws, is a curved plate, somewhat resembling the human hand, which grasps the prominent back and side in the region of most marked deformity. The portion of the plate corresponding to the thumb exerts pressure diagonally forward in the direction somewhat of the posterior third of the ribs against the bodies of the rotated vertebræ. That portion of the plate corresponding to the fingers and palm of the hand passes outward and forward around the prominent side to a point corresponding to the mid-axillary line. Similarly an oval plate with a slot and screw adjustment is attached to the top of the front upright as a point of counter-pressure to the back plate, just as the plates are used in the modified Schede forcible correction machine.

Thus, it will be seen that by adjusting the upper screw in the pelvic band fastening the posterior upright, any desired amount of force may be used through "the fingers" of the plate to overcome the lateral leaning—*i. e.*, the compensatory or secondary lumbar curve.

By means of bending irons quite an amount of diagonal forward force may be imparted to "the thumb" portion of the plate, to antagonize the rotation and the primary curve, and this force can be increased at will, depending on the rigidity of the steel upright in the back. Similarly with bending irons the diagonal backward force may be increased by bending the anterior upright.

In the case of double curves two uprights and plates can be used in the back on opposite sides and in different horizontal planes.

In some cases it has proved beneficial to have an axillary strap pass from the tip of the so-called "thumb" around the shoulder to the "fingers" of the posterior plate, especially where the rotated ribs have lifted the inferior angle of the scapula upward and backward. By means of tightening this strap with the plate high up, force can be exerted against the prominent ribs through the scapula, which, together, gives these cases, when viewed from the side, a humpbacked appearance.

Where one shoulder is dropped very much an axillary crutch

may be projected upward from the pelvic band simply as a cosmetic device, for, after all, general appearance and carriage are second only in importance in these cases to actual cure.

I reapply this brace daily, and adjust it after the patient has exercised and has been forcibly corrected while suspended.

The photographs of one of my cases will, I think, show the improvement following this line of treatment as well as how the brace is applied and worn. It cannot be detected through the clothes, and is not complained of as being uncomfortable. It is worn day and night, as many vicious attitudes may be assumed without it, and the corrective forces are at work constantly with it on. These cases exercise at night without the brace, and reapply it in suspension before retiring.

A jury-mast attachment or head-support with a lateral, movable joint at the pelvic band is helpful in partially flexible cases in younger children in removing a portion of the superincumbent weight, which is generally recognized as an etiological factor in increasing this deformity.

The weight of this brace in its simplest form when compared with a plaster jacket and a paper jacket, each of which had been worn by one of my patients, showed that it weighed three pounds, while the paper jacket weighed three pounds and the plaster jacket weighed two and three-quarter pounds.

To sum up my views in regard to the rationale of this brace, I can best do so by recalling how we have all observed and inferred that many cases reached a severe grade of deformity by first presenting a lateral deviation and then a secondary rotation, both being increased by the superincumbent weight acting on a spine held habitually out of plumb.

Is it not fair, then, to infer that a reversed process may be possible (where advanced bone distortion has not taken place)—*i. e.*, first prevent any increase in and overcome as far as possible the lateral deviation, and with a certain amount of correcting force the rotation will then be lessened or obliterated?

Such has been my clinical experience with it.

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